

Azure Service Project

Chapter 3

3.1 Resource Group Creation (slides 18-19)

3.1.1 Create a resource group

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes 'Microsoft Azure', 'Upgrade', a search bar ('Search resources, services, and docs (G+)'), 'Copilot', and user information ('ajinad407@outlook.com', 'DEFAULT DIRECTORY'). Below the navigation is a breadcrumb trail: 'Home >'. The main title is 'Resource groups' with a '...' button. Underneath, it says 'Default Directory'. There are buttons for '+ Create', 'Manage view', 'Refresh', 'Export to CSV', 'Open query', and 'Assign tags'. A filter bar allows filtering by 'Subscription equals all', 'Location equals all', and 'Add filter'. The results table shows one record:

Name	Subscription	Location	Actions
fuent-core-infrastructure-rg	Azure subscription 1	East US	...

At the bottom, there are grouping and view options: 'No grouping' and 'List view'.

3.1.2 Create a resource inside a resource group

Resource groups

Overview

Subscription (myrg) : [Azure subscription 1](#)

Subscription ID : fd27c80a-839c-4099-bb90-9c4e8e76fa59

Tags (edit) : [Add tags](#)

Deployments : 2 [Succeeded](#)

Location : East US

Name	Type	Location
msftlearn-vnet1	Virtual network	East US
msftlearn-vnet2	Virtual network	East US

3.2 Creating Virtual Machine & Making Web Server (slides 24-27)

3.2.1 Create the virtual machine

myVM

Overview

Resource group (myrg) : [fiunct-core-infrastructure-rg](#)

Status : Running

Location : East US (Zone 2)

Subscription (myrg) : [Azure subscription 1](#)

Subscription ID : fd27c80a-839c-4099-bb90-9c4e8e76fa59

Availability zone : 2

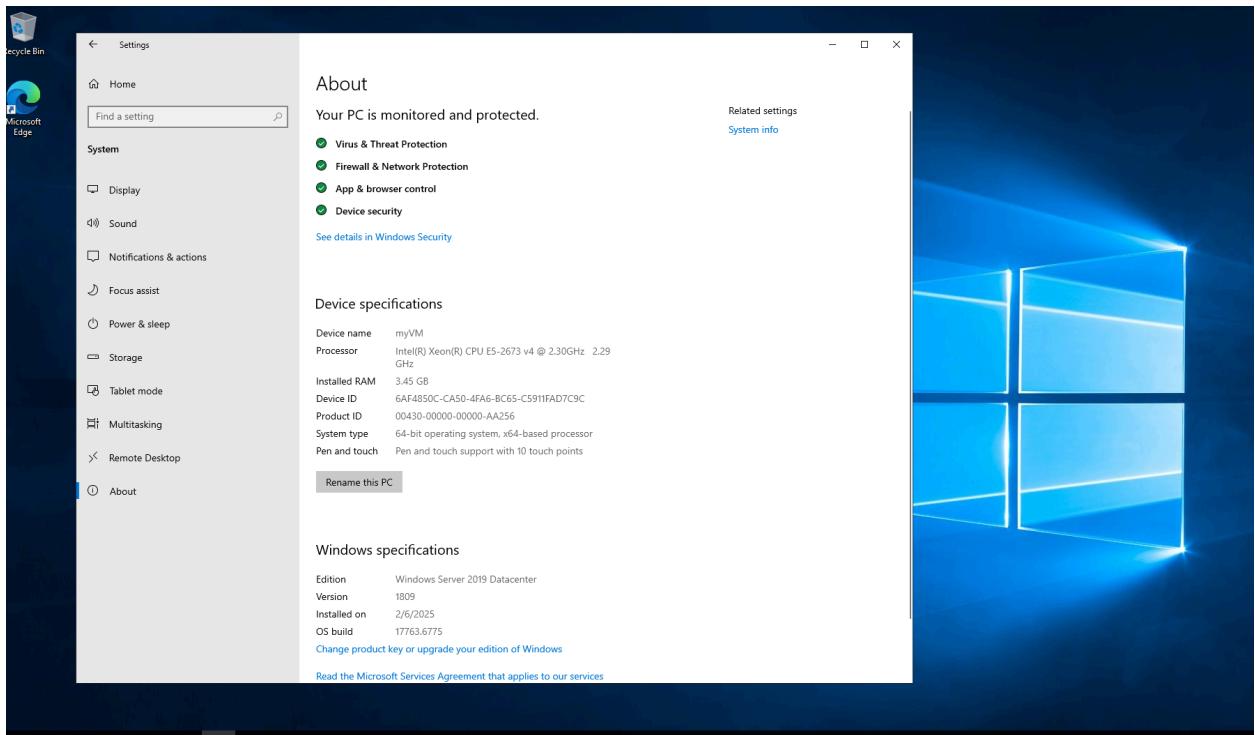
Tags (edit) : [Add tags](#)

Properties	Monitoring	Capabilities (8)	Recommendations	Tutorials
Virtual machine				
Computer name	myVM			
Operating system	Windows (Windows Server 2019 Datacenter)			
VM generation	V2			
VM architecture	x64			
Agent status	Ready			
Agent version	2.7.41491.1095			

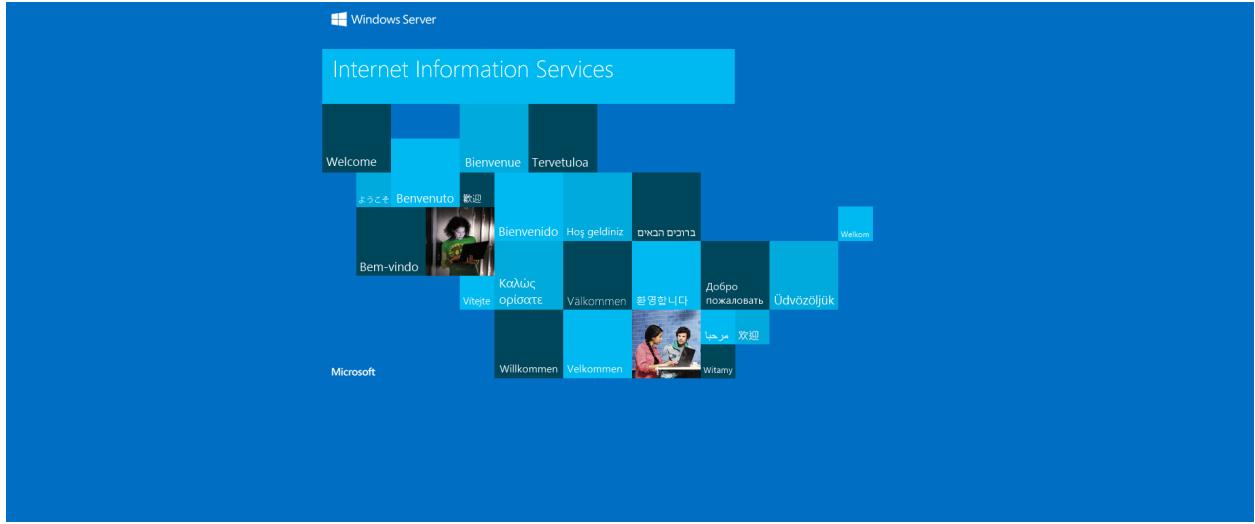
Networking

Public IP address	20.83.163.50 (Network interface myvm945_22)
Public IP address (IPv6)	-
Private IP address	192.168.0.4
Private IP address (IPv6)	-
Virtual network/subnet	msftlearn-vnet1/default
DNS name	Configure

3.2.2 Connect to the virtual machine



3.2.3 Install the web server role and test



3.3 Deploy Azure Container Instances (slides 33-35)

3.3.1 Create a container instance

mycontainer Container instances

Resource group (move) : CH3ResourceGroup

Status : Running

Location : East US

Subscription (move) : Azure subscription 1

Subscription ID : fd27c80a-839c-4099-bb90-9c4e8e76fa59

Tags (edit) : Add tags

CPU Usage (Avg), mycontainer | 1

Memory Usage (Avg), mycontainer | 20.19MB

Network Bytes Received Per Second (Avg), myco... | 4.5B

3.3.2 Verify deployment of the container instance

Welcome to Azure Container Instances!



3.4 Create a virtual network (slides 37-40)

3.4.1 Create a virtual network

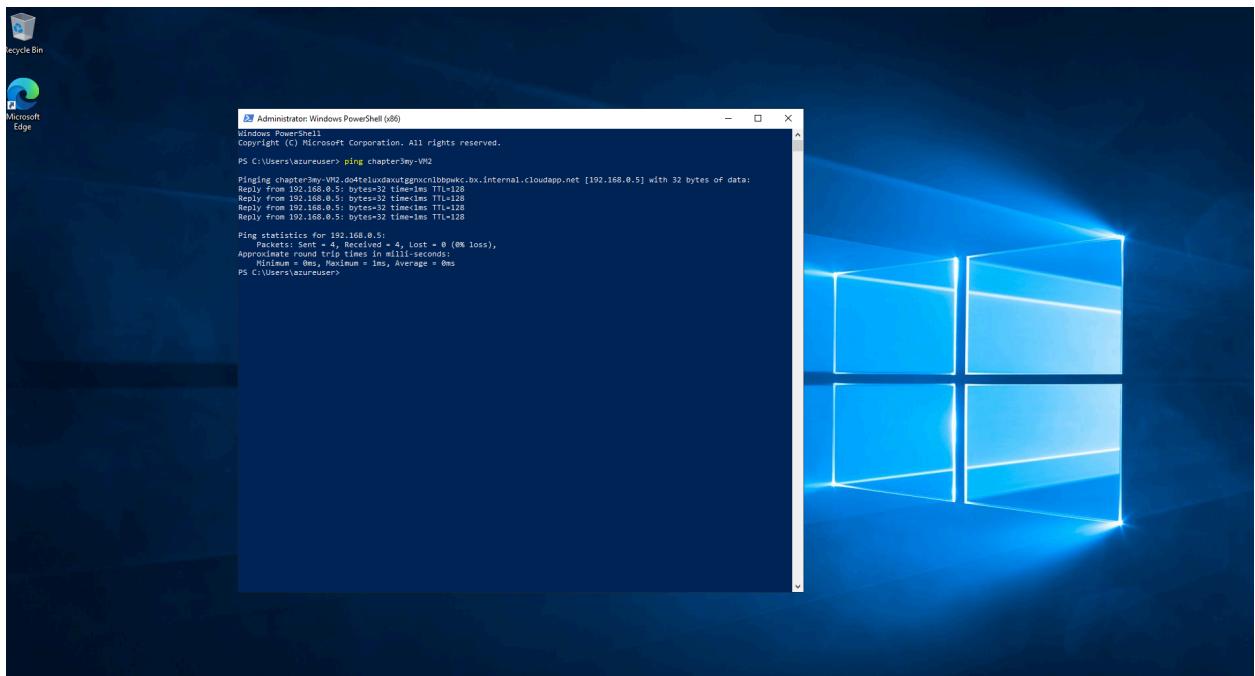
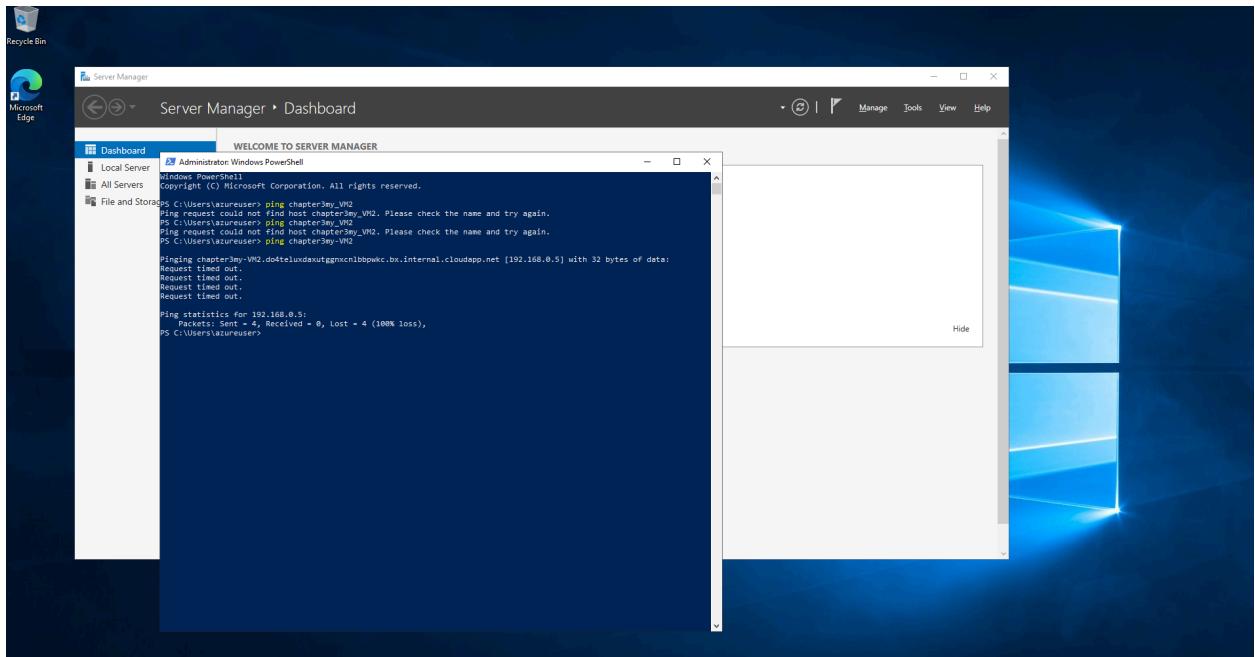
The screenshot shows the Azure portal interface for a virtual network named 'msftlearn-vnet3'. The left sidebar contains navigation links like Home, Overview, Activity log, Tags, Diagnose and solve problems, Settings (Address space, Connected devices, Subnets, Bastion, DDoS protection, Firewall, Microsoft Defender for Cloud, Network manager, DNS servers, Peering, Service endpoints, Private endpoints, Properties, Locks), Monitoring, and a Default Directory link. The main content area displays the 'Essentials' section with details such as Resource group (CH3ResourceGroup), Location (East US), Subscription (Azure Subscription 1), Subscription ID, Address space (192.168.0.0/24), DNS servers (Azure provided DNS service), Flow timeout (Configure), BGP community string (Configure), and Virtual network ID (2e32bd1b-1897-492f-98cd-b89ab085f652). Below this, there are sections for Tags (edit, Add tags), Capabilities (DDoS protection, Azure Firewall, Peering, Microsoft Defender for Cloud, Private endpoints), and Recommendations/Tutorials.

3.4.2 Create two virtual machines

The screenshot shows the Azure portal interface for the 'Virtual machines' list. The left sidebar includes a Default Directory link. The main content area features a search bar, filter options (Subscription equals all, Type equals all, Resource group equals all, Location equals all, Add filter), and a table header with columns: Name, Subscription, Resource group, Location, Status, Operating system, Size, Public IP address, Disks, and Update status. The table lists three virtual machines: 'Chapter3my-VM1' and 'chapter3my-VM2', both running Windows operating systems in the East US location. Both VMs have a public IP address assigned and one disk, with the update status set to 'Enable periodic assessment'.

Name	Subscription	Resource group	Location	Status	Operating system	Size	Public IP address	Disks	Update status
Chapter3my-VM1	Azure subscription 1	CH3ResourceGroup	East US	Running	Windows	Standard_DS1_v2	172.174.239.209	1	Enable periodic assessment
chapter3my-VM2	Azure subscription 1	CH3ResourceGroup	East US	Running	Windows	Standard_DS1_v2	20.84.66.10	1	Enable periodic assessment

3.4.3 Test the connection



3.5 Create Blob Storage (slides 45-48)

3.5.1 Create a storage account

storageaccount407 Storage account

Overview

Resource group: C3ResourceGroup
Location: eastus
Subscription: Azure subscription 1
Subscription ID: fd27c80a-839c-4099-bb90-9c4e8e76fa59
Disk state: Available
Tags: Add tags

Properties

Setting	Value
Hierarchical namespace	Disabled
Default access tier	Hot
Blob anonymous access	Disabled
Blob soft delete	Enabled (7 days)
Container soft delete	Enabled (7 days)
Versioning	Disabled
Change feed	Disabled
NFS v3	Disabled
Allow cross-tenant replication	Disabled
Storage tasks assignments	None

Blob service

Setting	Value
Large file share	Enabled
Identity-based access	Not configured
Default share-level permissions	Disabled

File service

Setting	Value
Require secure transfer for REST API operations	Enabled
Storage account key access	Enabled
Minimum TLS version	Version 1.2
Infrastructure encryption	Disabled

Security

Setting	Value
Allow access from	All networks
Private endpoint connections	0
Network routing	Microsoft network routing
Access for trusted Microsoft services	Yes
Endpoint type	Standard

Networking

3.5.2 Work with blob storage

container1 Container

Overview

Authentication method: Access key (Switch to Microsoft Entra user account)
Location: container1

Name	Modified	Access tier	Archive status	Blob type	Size	Lease state
CompTIA Network+ N10-007 Hands-on Lab Simulator Lite.exe	2/6/2025, 12:47:12 PM	Hot (Inferred)		Block blob	76 KB	Available

3.5.3 Monitor the storage account (not required)

3.6 Create a SQL database (slides 50-52)

3.6.1 Create the database

Microsoft Azure Upgrade

Home > Microsoft.SQLDatabase.newDatabaseNewServer_f45a9581dc804b65983fb | Overview >

sqlserver407 (sqlserver407/sqlserver407)

SQL database

Copy Restore Export Set server firewall Delete Connect with... Feedback

Overview Activity log Tags

Mirror databases in Microsoft Fabric Easily replicate your existing databases in Fabric, and help your team achieve streamlined ETL and operational analytics goals. [Learn more](#)

JSON View

Resource group (move): CH9ResourceGroup
Status: Online
Location: East US 2
Subscription (move): Azure subscription 1
Subscription ID: f6d7c780a-839c-4099-bb90-9c4e8e76fa59
Tags (edit): Add tags

Server name: sqlserver407.database.windows.net
Connection strings: Show database connection strings
Pricing tier: General Purpose - Serverless: Gen5, 1 vCore
Auto-pause delay: 1 hour
Earliest restore point: No restore point available

Getting started Monitoring Properties Notifications (0) Integrations Tutorials

Database data storage
Review the below metrics and monitor your applications and infrastructure.

Used space: 10.44 MB, Remaining space: 31.99 GB, Allocated space: 16 MB, Max storage: 32 GB

Key metrics
Review the below metrics and monitor your applications and infrastructure or [See all metrics](#)

Show data for last: 1 hour 24 hours 7 days Aggregation type: Max

Compute utilization

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%

12:15 12:30 12:45 UTC+00:00

CPU utilization (Max)
col_instance.cpu_percent
col_instance.log_percent
log_write_percent
workers_percent

Additional monitoring

- Get alerted to issues Create alerts to monitor resource health, usage, cost and more. [Start](#)
- Monitor at scale Get full insights of your database and optimize for better usage. [Start](#)
- Scale compute or storage Scale up if you see high CPU or memory utilization. [Start](#)
- Get started with Log Analytics Edit and run log queries from data collected by Azure Monitor. [Start](#)

3.6.2 Test the database

The screenshot shows the Microsoft Azure portal interface for a SQL database named 'sqlserver407'. The left sidebar contains navigation links for Overview, Activity log, Tags, Diagnose and solve problems, and a 'Query editor (preview)' section which is currently selected. The main area displays a query editor titled 'Query 1' with the following T-SQL code:

```
1 SELECT TOP 20 pc.Name as CategoryName, p.name as ProductName FROM SalesLT.ProductCategory  
2 pc JOIN SalesLT.Product p ON pc.productcategoryId = p.productcategoryId;
```

The results pane shows a table with two columns: 'CategoryName' and 'ProductName'. The data includes:

CategoryName	ProductName
Road Frames	HL Road Frame - Black, 58
Road Frames	HL Road Frame - Red, 58
Helmets	Sport-100 Helmet, Red
Helmets	Sport-100 Helmet, Black
Socks	Mountain Bike Socks, M
Socks	Mountain Bike Socks, L
Helmets	Sport-100 Helmet, Blue
Cans	AWC Iona Can

At the bottom of the results pane, it says 'Query succeeded | 0s'.

Chapter 4

4.1 Implement the Azure IoT Hub (slides 5-8)

4.1.1 Create an IoT Hub

The screenshot shows the Microsoft Azure portal interface for an IoT hub named 'my-hub-group407'. The left sidebar contains navigation links for Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Events, Device management, Hub settings, Security settings, Defender for IoT, Monitoring, Automation, and Help. The 'Overview' section is selected. The main area displays the IoT Hub's configuration details and usage metrics.

Configuration Details:

- Resource group: CH1ResourceGroup
- Status: Active
- Location: East US
- Service region: East US
- Subscription: Azure subscription 1
- Tags: (edit) : Add tags

Usage Metrics:

Show data for last: 1 Hour, 6 Hours, 12 Hours, 1 Day (selected), 7 Days, 30 Days

IoT Hub Usage	Device to cloud messages
<ul style="list-style-type: none">Messages used today: 0Daily messages quota: 400000IoT Devices: 0	<ul style="list-style-type: none">Total number of messages used (Max), my-hub-group407: 0

4.1.2 Add an IoT device

The screenshot shows the Azure IoT Hub Device configuration page for a device named 'myRaspberryPi'. The 'Configurations' tab is selected. Key fields include:

- Device ID: myRaspberryPi
- Primary key: [REDACTED]
- Secondary key: [REDACTED]
- Primary connection string: [REDACTED]
- Secondary connection string: [REDACTED]
- Tags: No tags
- Enable connection to IoT Hub: Enabled
- Parent device: No parent device

Below the configurations, there's a table for Module Identities and a note stating: "There are no module identities for this device."

4.1.3 Test the device using the Raspberry Pi Simulator

The screenshot shows the Raspberry Pi Azure IoT Online Simulator. On the left, a breadboard setup is shown with a BME280 sensor connected to a Raspberry Pi Model B+ Rev 2. The breadboard connections are highlighted with red boxes. On the right, the simulator interface displays a script running on the device. The script reads sensor data and sends messages to the Azure IoT Hub. The message content includes device ID, temperature, and humidity.

```
/*
 * IoT Hub Raspberry Pi Node.js - Microsoft Sample Code - Copyright (c) 2017 - Licensed MIT
 */
const ws = require('ws');
const Client = require('azure-iot-device').Client;
const Message = require('azure-iot-device').Message;
const IoTHubClient = require('azure-iot-device').IoTHubClient;
const BME280 = require('bme280');

const BME280_OPTION_1 = {
    i2cBusNo: 1, // defaults to 1
    i2cAddress: BME280.BME280_DEFAULT_I2C_ADDRESS() // defaults to 0x77
};

const connectionString = 'HostName=my-hub-group407.azure-devices.net;DeviceId=myRaspberryPi;SharedAccessKey=OhiLnLV2e8JKao+o7hjQObpu0nLdPfIn'; // replace with your hub's connection string
const IoTHub = IoTHubClient.createClient(connectionString);
const LEDPin = 4;

var sendingMessage = false;
var messageId = 0;
var client, sensor;
var blinkIEDTTimeout = null;
var messageID = 0;
var deviceID = 'Raspberry Pi Web Client';
var testTemp = data.temperature_C;
var humidity = data.humidity;
var tempAlert = data.temperature_C > 30;
var err;

function printMessage(cb) {
    client
        .receiveEvent('temperature')
        .then(function(data) {
            cb(data);
        })
        .catch(function(err) {
            console.error('Failed to read out sensor data: ' + err);
        });
}

function sendMessage() {
    if (!sendingMessage) {
        return;
    }
    var message = new Message(content);
    message.messageId = messageId;
    message.deviceId = deviceID;
    message.content = content;
    IoTHub.sendEvent('temperature', message);
    messageId++;
}

IoTHub.on('message', function(message) {
    var content = JSON.parse(message.data);
    if (content.messageId === 9) {
        if (tempAlert) {
            content.messageId = 10;
            content.content = 'Temperature Alert';
        } else {
            content.messageId = 11;
            content.content = 'Normal Temperature';
        }
        sendMessage();
    }
});

IoTHub.on('error', function(error) {
    console.error(error);
});
```

my-hub-group407

Overview

Resource group (moved) : CH3ResourceGroup

Status : Active

Location : East US

Service region : East US

Subscription (moved) : Azure subscription 1

Tags (edit) : Add tags

See more

Hostname : my-hub-group407.azure-devices.net

Tier : Standard

Daily message limit : 400,000

Minimum TLS Version : 1.0

JSON View

IoT Hub Usage

Number of messages used

Device to cloud messages

Show data for last: 1 Hour, 6 Hours, 12 Hours, 1 Day, 7 Days, 30 Days

Messages used today: 25

Daily messages quota: 400,000

IoT Devices: 1

Total number of messages used (Max), my-hub-gr... 25

Telemetry messages sent (Sum), my-hub-gr... 21

4.2 Implement Azure Functions (slides 14-16)

4.2.1 Create a Function app

function407

All services > Function App

Function App

Create Manage view ...

Filter for any field...

Name ↑...

function407

Overview

Your app is not configured for dynamic scaling. Scaling could be limited. Click to learn more.

Resource group (moved) : CH3ResourceGroup

Status : Running

Location (moved) : UK South

Subscription (moved) : Azure subscription 1

Subscription ID : fd27c80a-839c-4099-bb90-9c4e8e76fa59

Tags (edit) : Add tags

Default domain : function407.azurewebsites.net

Operating System : Windows

App Service Plan : ASP-CH3ResourceGroup-a12f(Y1:0)

Runtime version : 4.1037.23521

Functions Metrics Properties Notifications (1)

Create functions in your preferred environment

Create with Visual Studio

VS Code Desktop

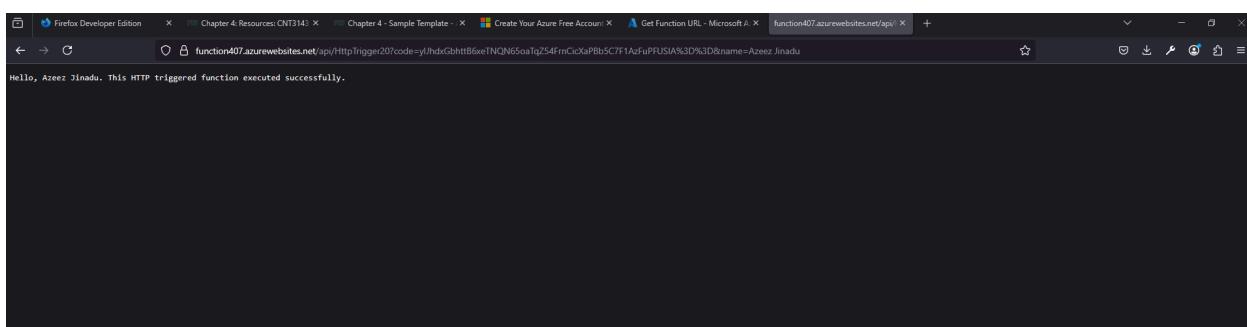
Other editors or CLI

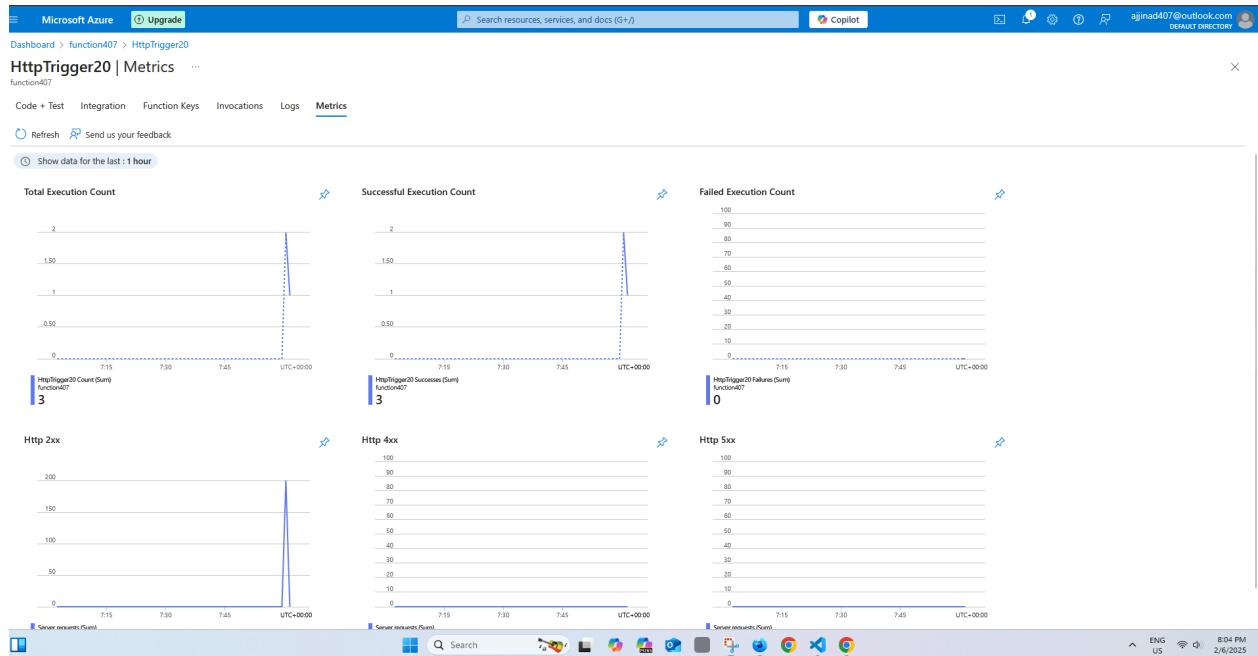
Page 1 of 1

ENGLISH US 2:49 PM 2/6/2025

4.2.2 Create an HTTP triggered event function and test

```
1  using System;
2  using System.IO;
3  using System.Threading.Tasks;
4  using Microsoft.Azure.WebJobs;
5  using Microsoft.Azure.WebJobs.Extensions.Http;
6  using Microsoft.AspNetCore.Http;
7  using Microsoft.Extensions.Logging;
8  using Newtonsoft.Json;
9
10 namespace FIU.Function
11 {
12     public static class HttpTrigger20
13     {
14         [FunctionName("HttpTrigger20")]
15         public static async Task<ActionResult> Run(
16             [HttpTrigger(AuthorizationLevel.Function, "get", "post", Route = null)] HttpRequest req,
17             ILogger log)
18         {
19             log.LogInformation("C# HTTP trigger function processed a request.");
20
21             string name = req.Query["name"];
22
23             string requestBody = await new StreamReader(req.Body).ReadToEndAsync();
24             dynamic data = JsonConvert.DeserializeObject(requestBody);
25             name = name ?? data?.name;
26
27             string responseMessage = string.IsNullOrEmpty(name)
28                 ? "This HTTP triggered function executed successfully. Pass a name in the query string or in the request body for a personalized response."
29                 : $"Hello, {name}. This HTTP triggered function executed successfully.";
30
31             return new OkObjectResult(responseMessage);
32         }
33     }
34 }
```





4.3 Create a Web App (slides 19-21)

4.3.1 Create a Web App

The screenshot shows the Azure portal's 'Web App' configuration page for 'myFIUDockerWebApp407'.

Essentials:

- Resource group: CH3ResourceGroup
- Status: Running
- Location: UK South
- Subscription: Azure subscription 1
- Subscription ID: fd27c80a-839c-4099-bb90-9c4e8e76fa59
- Tags: Add tags

Properties:

- Web app:**
 - Name: myFIUDockerWebApp407
 - Publishing model: Container
 - Container Image: index.docker.io/microsoft/aci-helloworld
- Domains:**
 - Default domain: myfiudockerwebapp407-crfzgzevgvgs... Show More
 - Custom domain: Add custom domain
- Hosting:**
 - Plan type: App Service plan
 - Name: ASP-CH3ResourceGroup-86f0
 - Operating System: Linux
 - Instance Count: 1
 - SKU and size: Basic (B1) Scale up

Deployment Center: View logs

Application Insights: Name: Enable Application Insights

Networking:

- Virtual IP address: 20.90.133.1
- Outbound IP addresses: 85.210.96.145.4.158.1.157.85.210.176.1... Show More
- Additional Outbound IP addresses: 85.210.96.145.4.158.1.157.85.210.176.1... Show More
- Virtual network integration: Not configured

4.3.2 Test the Web App

Welcome to Azure Container Instances!



4.4 Create a VM with an ARM Template (slides 24-26)

4.4.1 Explore the gallery and locate a template

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with 'Microsoft Azure' and 'Upgrade' buttons, followed by a search bar and a Copilot button. Below the navigation is a breadcrumb trail: 'Home > Microsoft.Template-20250208110834 | Overview >'. The main area is titled 'Chapter04-Grp_Template' and shows 'Resource group' details: Subscription (move) to 'Azure subscription_1', Subscription ID 'fd27c80a-839c-4099-bb90-9c4e8e76fa59', Deployments '1 Succeeded', Location 'West US', and Tags 'Add.tags'. On the left, a sidebar lists various management categories like Activity log, Access control (IAM), Tags, Resource visualizer, Events, Settings, Deployments, Security, Deployment stacks, Policies, Properties, Locks, Cost Management, Cost analysis, Cost alerts (preview), Budgets, Advisor recommendations, Monitoring, Insights (preview), Alerts, Metrics, Diagnostic settings, Logs, Advisor recommendations, Workbooks, and Automation. The 'Resources' tab is selected in the center, displaying a table of 8 records:

Name	Type	Location	Actions
bootdiags5z7msn34xgoc	Storage account	West US	...
default-NSG	Network security group	West US	...
myPublicIP	Public IP address	West US	...
myVMNic	Network Interface	West US	...
myVMTemplate	Virtual machine	West US	...
myVMTemplate_disk2_7f409fac74f54c1c881be5c1027e0731	Disk	West US	...
myVMTemplate_OsDisk_1_7d4a179109f04a869f2c87a2916e086	Disk	West US	...
MyVN	Virtual network	West US	...

4.4.2 Verify and monitor your virtual machine deployment

4.5 Create a VM with PowerShell (slides 27-30)

4.5.1 Configure PowerShell locally

```

PS /home/azeer> Get-AzResourceGroup | Format-List
ResourceGroupName : Chapter04-Grp_Template
Location          : westus
ProvisioningState : Succeeded
Tags              :
ResourceId        : /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/Chapter04-Grp_Template

ResourceGroupName : NetworkWatcherRG
Location          : westus
ProvisioningState : Succeeded
Tags              :
ResourceId        : /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/NetworkWatcherRG

ResourceGroupName : fiuclt-core-infrastructure-rg
Location          : eastus
ProvisioningState : Succeeded
Tags              :
ResourceId        : /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/fiuclt-core-infrastructure-rg

ResourceGroupName : CH3ResourceGroup
Location          : eastus
ProvisioningState : Succeeded
Tags              :
ResourceId        : /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/CH3ResourceGroup

```

4.5.2 Verify resource group and Create a virtual machine

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes 'Microsoft Azure', 'Upgrade', 'Search resources, services, and docs (G+)', 'Copilot', and user information 'ajinad407@outlook.com'. The main content area is titled 'myVMPS' under 'Virtual machines'. The left sidebar lists various management options like 'Create', 'Switch to classic', and 'Networking'. The right pane displays detailed information about the VM, including its 'Essentials' (Resource group: 'fiucnt-rg', Status: 'Running', Location: 'West US', Subscription: 'Azure subscription 1'), 'Properties' (Computer name: 'myVMPS', Operating system: 'Windows (Windows Server 2022 Datacenter Azure Edition)', Size: 'Standard D2s v3 (2 vcpus, 8 GiB memory)'), and 'Networking' (Public IP address: '13.64.53.102'). A 'Tags' section shows 'Add tags'. Below these are sections for 'Virtual machine', 'Networking', 'Size', and 'Source image details'.

4.5.3 Execute commands in the Cloud Shell

The screenshot shows the Azure Cloud Shell interface. The top navigation bar includes 'Microsoft Azure', 'Upgrade', 'Search resources, services, and docs (G+)', 'Copilot', and user information 'ajinad407@outlook.com'. The main area is titled 'All services' and shows categories like 'AI + machine learning', 'Compute', and 'Containers'. Below this is a terminal window with the following content:

```

Switch to Bash  Restart  Manage files  New session  Editor  Web preview  Settings  Help  X

Requesting a Cloud Shell. Succeeded.
Connecting terminal...
Your Cloud Shell session will be ephemeral so no files or system changes will persist beyond your current session.
MOTD: Azure Cloud Shell now includes Predictive IntelliSense! Learn more: https://aka.ms/CloudShell/IntelliSense
VERBOSE: Authenticating to Azure ...
VERBOSE: Building your Azure drive ...
PS /home/azeez> Get-AzVM -Name myVMPS -Status | Format-List

PowerState : VM running
MaintenanceRedeployStatus : FIUCNT-RG
ResourceGroupName : FIUCNT-RG
Id : /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/FIUCNT-RG/providers/Microsoft.Compute/virtualMachines/myVMPS
VmId : c356e72b-cd4b-4f02-aa85-4a1bacb43662
Name : myVMPS
Type : Microsoft.Compute/virtualMachines
Location : westus
ExtendedLocation :
LicensesType :
Tags : {}
AvailabilitySetReference :
DiagnosticsProfile :
Extensions : {}
HardwareProfile : Microsoft.Azure.Management.Compute.Models.HardwareProfile
InstanceView :
NetworkProfile : Microsoft.Azure.Management.Compute.Models.NetworkProfile
SecurityProfile : Microsoft.Azure.Management.Compute.Models.SecurityProfile
OsName : Windows Server 2022 Datacenter Azure Edition
OsVersion : 10.0.20348.3091

```

```

PS /home/azeez> Get-AzVM -name myVMPS -status | Format-List
PowerState          : VM deallocated
MaintenanceRedeployStatus : 
ResourceGroupName   : FIUCNT-RG
Id                 : /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/FIUCNT-RG/providers/Microsoft.Compute/virtualMachines/myVMPS
VmId               : c356e72b-cd4b-4f02-aa85-4a1bacb43662
Name               : myVMPS
Type               : Microsoft.Compute/virtualMachines
Location           : westus
ExtendedLocation    :
LicenseType        :
Region             :
AvailabilitySetReference :
DiagnosticsProfile :
Extensions         :
HardwareProfile    : Microsoft.Azure.Management.Compute.Models.HardwareProfile
InstanceView        :
NetworkProfile     : Microsoft.Azure.Management.Compute.Models.NetworkProfile
SecurityProfile    : Microsoft.Azure.Management.Compute.Models.SecurityProfile
OsName             :
OsVersion          :
HyperVGeneration  :
OSProfile          : Microsoft.Azure.Management.Compute.Models.OSProfile
BillingProfile     :
Plan                :
ProvisioningState  : Succeeded
StorageProfile     : Microsoft.Azure.Management.Compute.Models.StorageProfile
DisplayHint        : Compact
Identity            :

```

4.6 Create a VM with the Azure CLI (slides 31-35)

4.6.1 Configure the Cloud Shell

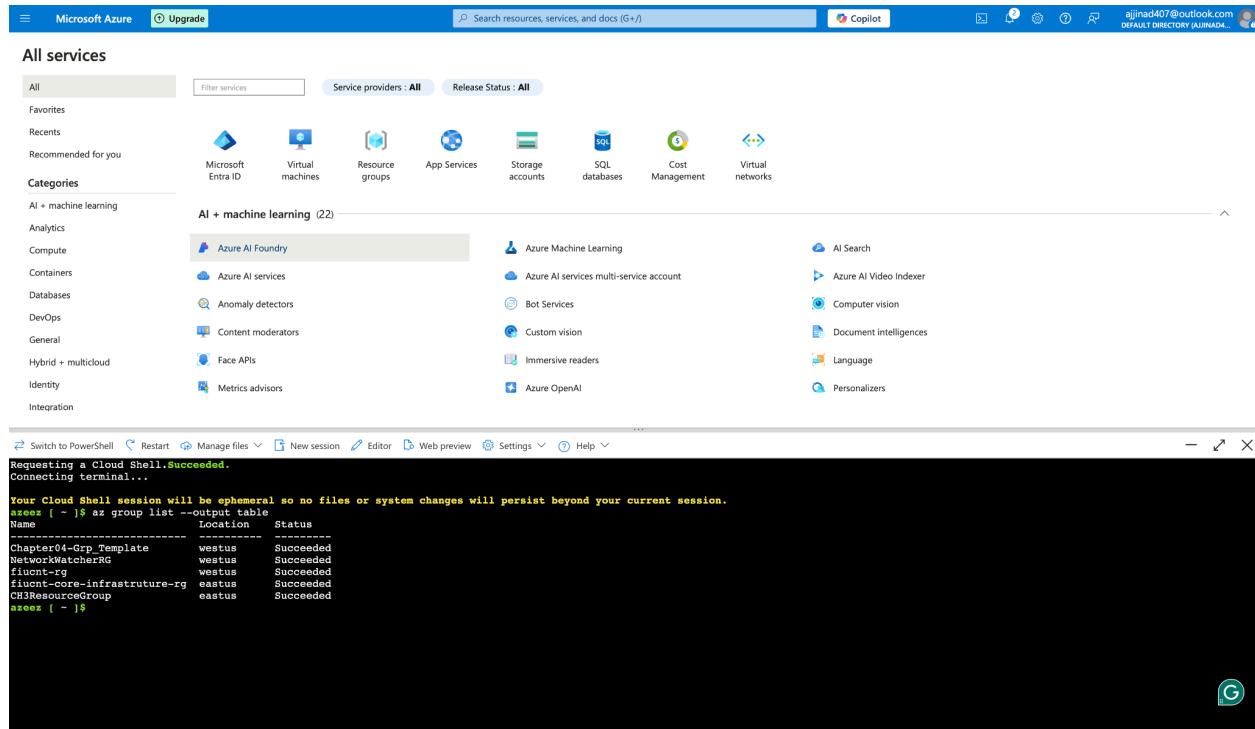
Requesting a Cloud Shell...Succeeded.
Connecting terminal...
Your Cloud Shell session will be ephemeral so no files or system changes will persist beyond your current session.

```

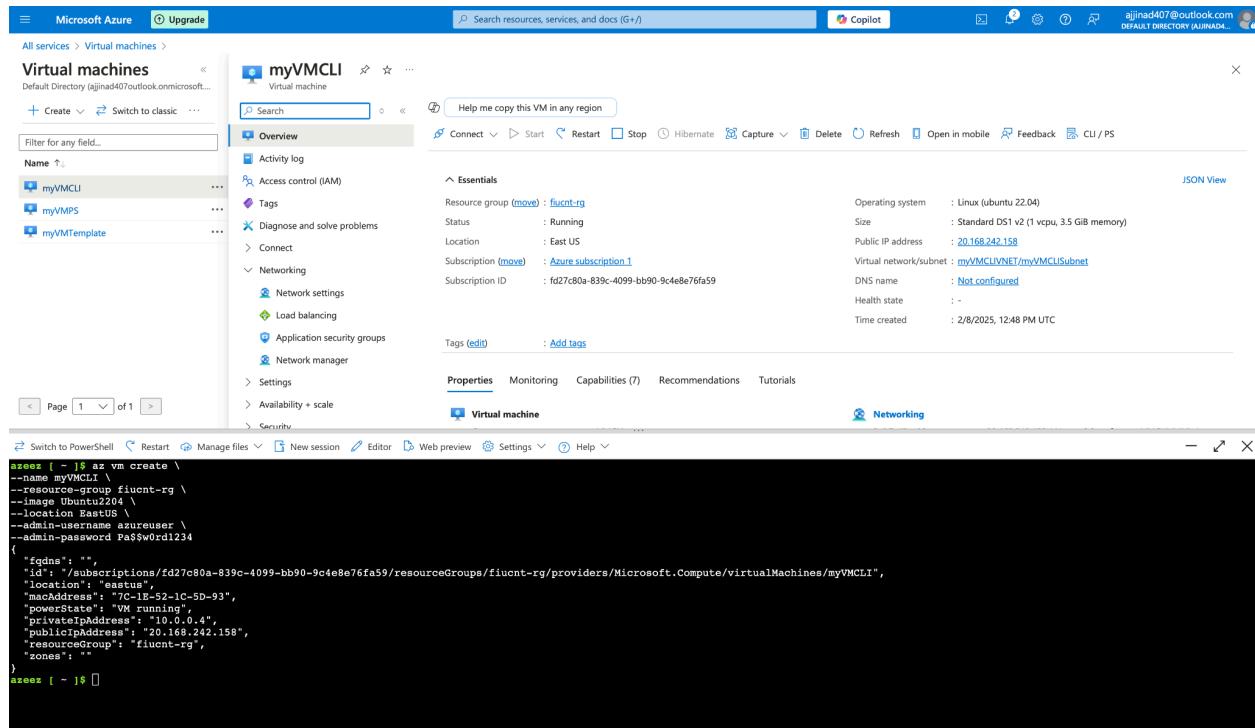
azeez: ~ $ 

```

4.6.2 Verify resource group and Create a virtual machine



```
Your Cloud Shell session will be ephemeral so no files or system changes will persist beyond your current session.
azeez [ ~ ]$ az group list --output table
Name          Location   Status
-----
Ch3ResourceGroup        westus    Succeeded
NetworkWatcherRG        westus    Succeeded
fuent-rg                westus    Succeeded
fuent-core-infrastructure-rg eastus    Succeeded
CH3ResourceGroup        eastus    Succeeded
```



```
azeez [ ~ ]$ az vm create \
--name myVMCLI \
--resource-group fuent-rg \
--image UbuntuLTS \
--location EastUS \
--admin-username azureuser \
--admin-password Pa$$wrd1234
{
  "fqdns": "",
  "id": "/subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/fuent-rg/providers/Microsoft.Compute/virtualMachines/myVMCLI",
  "macAddress": "7C-1B-52-1C-5D-93",
  "powerState": "VM running",
  "privateIpAddress": "10.0.0.4",
  "publicIpAddress": "20.168.242.158",
  "resourceGroup": "fuent-rg",
  "zones": ""
}
azeez [ ~ ]$
```

4.6.3 Execute commands in the Cloud Shell

Virtual machines

myVMCLI

Essentials

Name	ResourceGroup	PowerState	PublicIps	Fqdns	Location	Zones
myVMCLI	fluent-rg	VM running	20.168.242.158		eastus	

Virtual machines

myVMCLI

Essentials

Name	ResourceGroup	PowerState	PublicIps	Fqdns	Location	Zones
myVMCLI	fluent-rg	VM stopped	20.168.242.158		eastus	

4.6.4 Review Azure Advisor Recommendations (No screenshot required)

Chapter 5

5.1 Secure network traffic (slides 11-15)

5.1.1 Create a virtual machine

Microsoft Azure Upgrade Search resources, services, and docs (G+) Copilot Home > myVMCPTS Virtual machine Help me copy this VM in any region Connect ▶ Start □ Stop ⏪ Hibernate ⏴ Capture ▶ Delete ⏴ Refresh Open in mobile Feedback CLI / PS Overview Activity log Access control (IAM) Tags Diagnose and solve problems Connect Networking Network settings Load balancing Application security groups Network manager Settings Availability + scale Security Backup + disaster recovery Operations Monitoring Insights Alerts Metrics Diagnostic settings Logs Workbooks Automation Help

Essentials

Resource group (move) : CHAPTER_5_GRP
Status : Running
Location : East US (Zone 2)
Subscription (move) : Azure subscription 1
Subscription ID : fd27c80a-839c-4099-bb90-9c4e8e76fa59
Availability zone : 2

Tags (edit) : Add tags

Operating system : Windows (Windows Server 2019 Datacenter)
Size : Standard DS1 v2 (1 vcpu, 3.5 GiB memory)
Public IP address : 52.249.220.190
Virtual network/subnet : myVMCPTS-vnet/default
DNS name : Not configured
Health state : -
Time created : 2/8/2025, 1:29 PM UTC

Virtual machine

Computer name	myVMCPTS
Operating system	Windows (Windows Server 2019 Datacenter)
VM generation	V2
VM architecture	x64
Agent status	Ready
Agent version	2.7.41491.1095
Hibernation	Disabled
Host group	-
Host	-
Proximity placement group	-
Colocation status	N/A
Capacity reservation group	-
Disk controller type	SCSI

Networking

Public IP address	52.249.220.190 (Network interface mympchpt5545_x2)
Public IP address (IPv6)	-
Private IP address	10.0.0.4
Private IP address (IPv6)	-
Virtual network/subnet	myVMCPTS-vnet/default
DNS name	Configure

Size

Size	Standard DS1 v2
vCPUs	1
RAM	3.5 GiB

Source image details

Source image publisher	MicrosoftWindowsServer
Source image offer	WindowsServer
Source image plan	2019-datacenter-gensecond

...
Azure Spot
Azure Spot : -
Azure Spot eviction policy : -

5.1.2 Create a network security group

5.1.3 Configure an inbound security port rule to allow RDP

The screenshot shows the Windows Settings application open to the 'About' page. On the left, there's a sidebar with various settings categories like Home, System, Display, Sound, Notifications & actions, Focus assist, Power & sleep, Storage, Tablet mode, Multitasking, Remote Desktop, and About. A search bar is at the top. The main content area has a heading 'About' and a sub-section 'Your PC is monitored and protected.' which lists 'Virus & Threat Protection', 'Firewall & Network Protection', 'App & browser control', and 'Device security'. It also includes a link 'See details in Windows Security'. To the right, there are 'Related settings' (System info) and a 'Rename this PC' button. Below this, there's a section for 'Device specifications' with details like Device name (myVMPCHPTS), Processor (Intel(R) Xeon(R) Platinum 8272CL CPU @ 2.60GHz 2.59 GHz), Installed RAM (3.45 GB), Device ID (23DF2887-8614-457D-97A0-D41E3B86153C), Product ID (00430-00000-00000-AA946), System type (64-bit operating system, x64-based processor), and Pen and touch (Pen and touch support with 10 touch points). At the bottom, there's a 'Windows specifications' section with Edition (Windows Server 2019 Datacenter), Version (1809), Installed on (2/8/2025), OS build (17763.6775), a 'Change product key or upgrade your edition of Windows' link, and a 'Read the Microsoft Services Agreement that applies to our services' link.

Your PC is monitored and protected.

- Virus & Threat Protection
- Firewall & Network Protection
- App & browser control
- Device security

See details in Windows Security

Device specifications

Device name	myVMPCHPTS
Processor	Intel(R) Xeon(R) Platinum 8272CL CPU @ 2.60GHz 2.59 GHz
Installed RAM	3.45 GB
Device ID	23DF2887-8614-457D-97A0-D41E3B86153C
Product ID	00430-00000-00000-AA946
System type	64-bit operating system, x64-based processor
Pen and touch	Pen and touch support with 10 touch points

Rename this PC

Windows specifications

Edition	Windows Server 2019 Datacenter
Version	1809
Installed on	2/8/2025
OS build	17763.6775

[Change product key or upgrade your edition of Windows](#)

[Read the Microsoft Services Agreement that applies to our services](#)

5.1.4 Configure an outbound security port rule to deny Internet access

The screenshot shows the Microsoft Azure portal interface for a virtual machine named 'myVMCHPT5'. The user is viewing the 'Network settings' section. On the left, there's a navigation menu with options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Connect, Networking, Network settings, Settings, Disks, Extensions + applications, Operating system, Configuration, Advisor recommendations, Properties, Locks, Availability + scale, Security, Backup + disaster recovery, and Operations. The 'Network settings' option is currently selected.

Network interface:

- Name: myvmchpt5545_22
- Virtual network / subnet: myVMCHPT5-vnet / default
- Public IP address: 52.249.220.190
- Private IP address: 10.0.0.4
- Admin security rules: 0 (Configure)

Load balancers:

- : 0 (Configure)

Application security groups:

- : 0 (Configure)

Network security group:

- : myNSGSecur

Accelerated networking:

- : Enabled

Effective security rules:

- : 0

Rules:

Network security group myNSGSecur (attached to networkinterface: myvmchpt5545_22) Impacts 0 subnets, 1 network interfaces

Priority ↑	Name	Port	Protocol	Source	Destination	Action
300	AllowAnyRDPInbound	3389	TCP	Any	Any	Allow
65000	AllowVnetInbound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
65001	AllowAzureLoadBalancerInbound	Any	Any	AzureLoadBalancer	Any	Allow
65500	DenyAllInbound	Any	Any	Any	Any	Deny

The screenshot shows a browser window displaying an error message. The URL in the address bar is https://www.bing.com/search?q=https%3A%2F%2Fwww.microsoft.com+.&cvid=ce4c8e73811b4bb8ae24b9ab2855ce&gs_lcrp=EgRIZGdIKgYIABBFGDlyBggAEUYOTIGCAEQRQg0MgYIAhBFGDwyBggDEUYPDIGCAQQRg0gElMTk...

Hmmm... can't reach this page

www.bing.com took too long to respond

Try:

- Checking the connection
- [Checking the proxy and the firewall](#)

ERR_CONNECTION_TIMED_OUT

Troubleshoot **Refresh**

Details

5.2 Implement Azure Key Vault (slides 24-25)

5.2.1 Create an Azure Key Vault

The screenshot shows the Azure Key Vault management interface. The top navigation bar includes 'Microsoft Azure', 'Upgrade', 'Search resources, services, and docs (G+)', 'Copilot', and user information ('ajinad407@outlook.com DEFAULT DIRECTORY'). The main page displays the 'kevaltest407' key vault under 'Resource groups > CHAPTER-5-GRP'. The 'Overview' tab is selected, showing basic information like Resource group (CHAPTER-5-GRP), Location (East US), Subscription (Azure subscription 1), and Subscription ID (fd27c80a-839c-4099-bb90-9c4e8e76fa59). The 'Essentials' section provides vault URI (https://kevaltest407.vault.azure.net/), Sku (Standard), Directory ID, Directory Name, Soft-delete status (Enabled), and Purge protection (Disabled). A note at the bottom recommends using a vault per application per environment. Below the overview are sections for 'Control access to key vault', 'Enable logging and set up alerts', and 'Turn on recovery options', each with a 'View' button. The left sidebar lists various management options: Activity log, Access control (IAM), Tags, Diagnose and solve problems, Access policies, Events, Objects, Settings, Access configuration, Networking, Microsoft Defender for Cloud, Properties, Locks, Monitoring, Automation, and Help.

5.2.2 Add a secret to the Key Vault (IGNORE)

The screenshot shows the Azure Key Vault secrets management interface. The top navigation bar includes 'Microsoft Azure', 'Upgrade', 'Search resources, services, and docs (G+)', 'Copilot', and user information ('ajinad407@outlook.com DEFAULT DIRECTORY'). The main page displays the 'ExamplePassword' secret under 'keyvaltest4075 | Secrets'. The 'Properties' section shows the secret was created on 2/8/2025, 3:58:20 PM and updated on 2/8/2025, 3:58:20 PM. The secret identifier is https://keyvaltest4075.vault.azure.net/secrets/ExamplePassword/9d99dfab24b04eb08dd47744964a0e58. The 'Settings' section includes fields for 'Set activation date' (radio buttons for 'Set activation date' and 'Set expiration date'), both currently empty. The 'Enabled' field is set to 'Yes'. The 'Tags' section shows '0 tags'. The 'Secret' section has a 'Content type (optional)' input field and a 'Hide Secret Value' button. The 'Secret value' field contains the value 'hvFKK96'. At the bottom are 'Apply', 'Discard changes', and 'Close' buttons, along with a 'Give feedback' link. The left sidebar lists 'Properties', 'Created', 'Updated', 'Secret identifier', 'Settings', 'Set activation date', 'Set expiration date', 'Enabled', 'Tags', 'Secret', 'Content type (optional)', and 'Secret value'.

5.3 Create an Azure Policy (slides 33-36)

5.3.1 Create a policy assignment

Allowed locations

Policy Assignment

Essentials

Name	: Allowed locations	Scope	: Azure subscription 1
Definition version (preview)	: 1.1.*	Excluded scopes	: --
Description	: --	Definition type	: Policy
Assignment ID	: /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/providers/Microsoft.Authorization/policyAssignm...	Policy enforcement	: Default
Assigned by	: --		

Parameters (1)

Parameter ID	Parameter name	Parameter value	Policy assignment parameter reference type
listOfAllowedLocations	listOfAllowedLocations	["Japanwest"]	User defined parameter

Resource selectors (0)

Overrides (0)

Exemptions (0)

Remediation (0)

Deployed resources

Managed identity

Search by parameter name All types

Edit columns

Give feedback

5.3.2 Test allowed location policy

Create a storage account

Basics

Azure Storage is a Microsoft-managed service providing cloud storage that is highly available, secure, durable, scalable, and redundant. Azure Storage includes Azure Blobs (objects), Azure Data Lake Storage Gen2, Azure Files, Azure Queues, and Azure Tables. The cost of your storage account depends on the usage and the options you choose below. [Learn more about Azure storage accounts](#)

Project details

Select the subscription in which to create the new storage account. Choose a new or existing resource group to organize and manage your storage account together with other resources.

Subscription * Azure subscription 1

Resource group * CHAPTER-5-GRP Create new

Instance details

Storage account name * storageaccount407

Region * (US) East US Deploy to an Azure Extended Zone Allowed locations (Policy details)

Primary service Select a primary service

Performance * Standard: Recommended for most scenarios (general-purpose v2 account) Premium: Recommended for scenarios that require low latency.

Redundancy * Locally-redundant storage (LRS)

Review + create

Give feedback

Create a storage account

Validation failed. Required information is missing or not valid.

Basics

Subscription	Azure subscription 1
Resource group	CHAPTER-5-GRP
Location	East US
Storage account name	storageaccount407
Primary service	
Performance	Standard
Replication	Locally-redundant storage (LRS)

Advanced

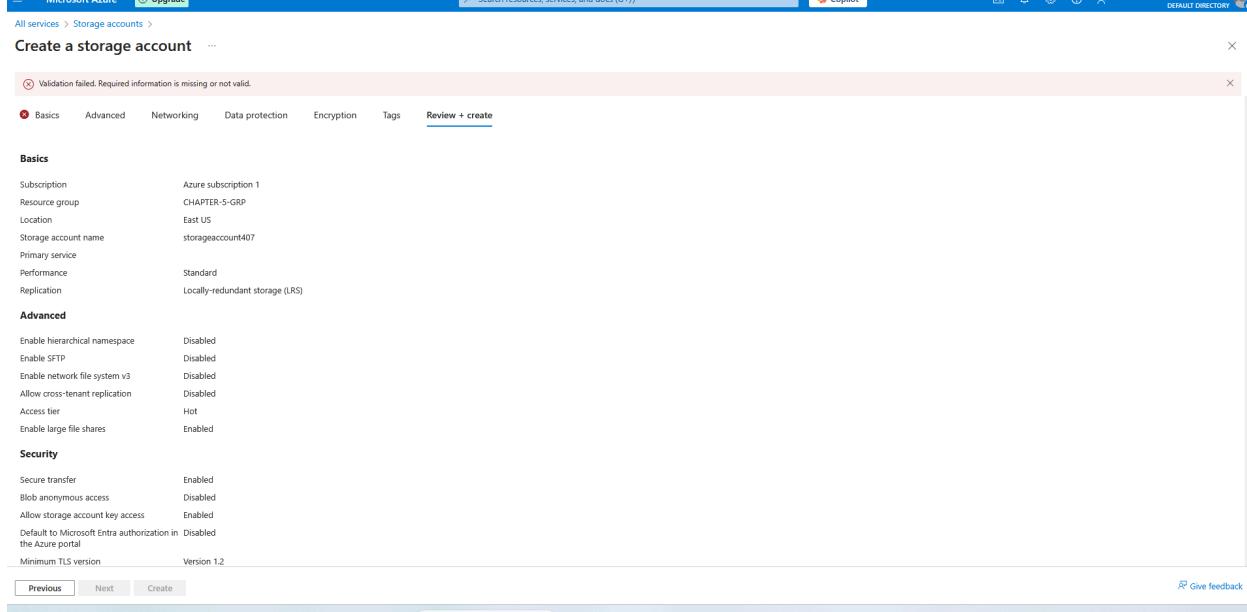
Enable hierarchical namespace	Disabled
Enable SFTP	Disabled
Enable network file system v3	Disabled
Allow cross-tenant replication	Disabled
Access tier	Hot
Enable large file shares	Enabled

Security

Secure transfer	Enabled
Blob anonymous access	Disabled
Allow storage account key access	Enabled
Default to Microsoft Entra authorization in the Azure portal	Disabled
Minimum TLS version	Version 1.2

[Previous](#) [Next](#) [Create](#)

Give feedback



5.3.3 Delete the policy assignment

Allowed locations

[Edit assignment](#) [Delete assignment](#) [Duplicate assignment](#) [View compliance](#) [View definition](#) [Create exemption](#) [Create remediation task](#)

Name	: Allowed locations	Scope	: Azure subscription 1
Definition version (preview)	: 1.*	Excluded scopes	: --
Description	: --	Definition type	: Policy
Assignment ID	: /subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/providers/microsoft.authorization/policyassignments/allowedlocations	Policy enforcement	: Default
Assigned by	: --		

[Parameters \(1\)](#) [Resource selectors \(0\)](#) [Overrides \(0\)](#) [Exemptions \(0\)](#) [Remediation \(0\)](#) [Deployed resources](#) [Managed Identity](#)

[Search by parameter name](#) [All types](#)

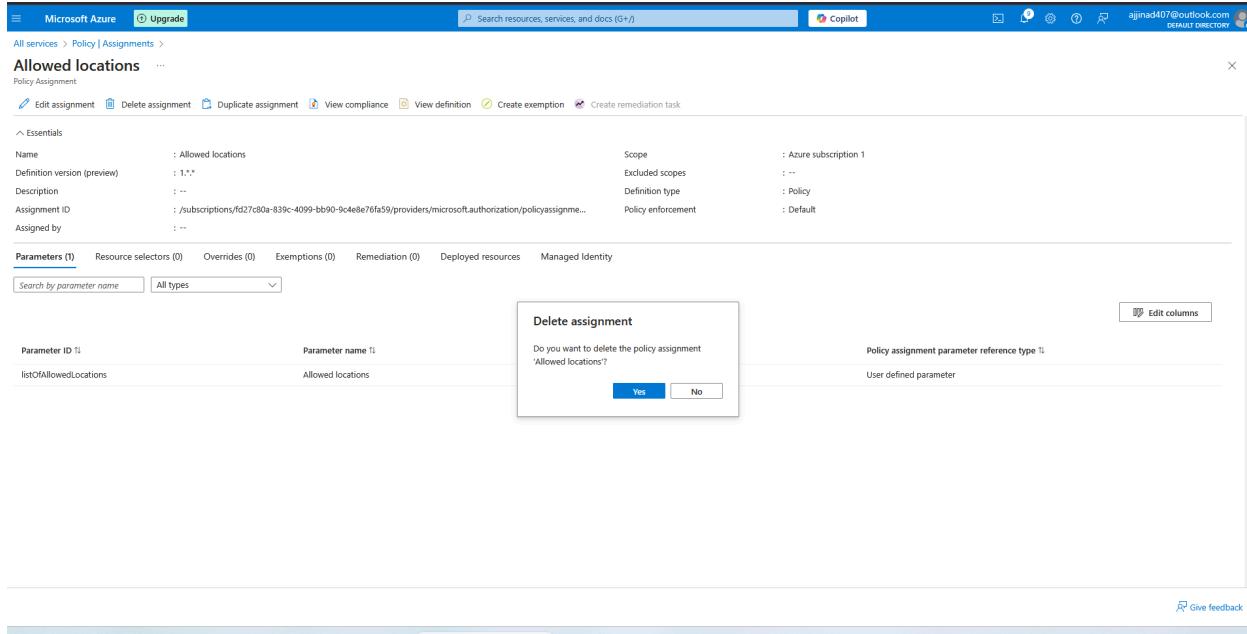
Delete assignment

Do you want to delete the policy assignment 'Allowed locations?'

[Yes](#) [No](#)

Policy assignment parameter reference type: User defined parameter

Give feedback



Policy | Assignments

Search: Filter by name or ID... Scope: Azure subscription 1 Definition type: All definition types

Total Assignments: 0 Initiative Assignments: 0 Policy Assignments: 0

Assignment name: Scope: Type:

No policies found in the given scope.

Notifications

- Successfully deleted assignment: Successfully deleted 'ASC Default (subscription: fd27c80a-839c-4090-bb90-9c4e8b7d5f50)' from 'Azure subscription 1'. Please note that the change takes around 30 minutes to take effect. a few seconds ago
- £155.49 credit remaining: Subscription 'Azure subscription 1' has a remaining credit of £155.49. Upgrade to a Pay-As-You-Go subscription. a minute ago

5.4 Manage access with RBAC (slides 38-40)

5.4.1 View and assign roles

myRBAC | Access control (IAM)

Resource group

Check access Role assignments Roles Deny assignments Classic administrators

A role definition is a collection of permissions. You can use the built-in roles or you can create your own custom roles. Learn more

Discover, monitor and remediate unused permissions in your Azure environment with Microsoft Entra Permissions Management. Learn more

Name	Description	Type	Category	Details
Owner	Grants full access to manage all resources, including the ability to assign roles in Azure RBAC.	BuiltinRole	General	View ...
Contributor	Grants full access to manage all resources, but does not allow you to assign roles in Azure RBAC.	BuiltinRole	General	View ...
Reader	View all resources, but does not allow you to make any changes.	BuiltinRole	General	View ...
Access Review Operator Service Role	Lets you grant Access Review System app permissions to discover and revoke access as needed.	BuiltinRole	None	View ...
AcrDelete	acr delete	BuiltinRole	Containers	View ...
AcrImageSigner	acr image signer	BuiltinRole	Containers	View ...
AcrPull	acr pull	BuiltinRole	Containers	View ...
AcrPush	acr push	BuiltinRole	Containers	View ...
AcrQuarantineReader	acr quarantine data reader	BuiltinRole	Containers	View ...
AcrQuarantineWriter	acr quarantine data writer	BuiltinRole	Containers	View ...
Advisor Recommendations Contributor	View assessment recommendations, accepted review recommendations, and manage the reco...	BuiltinRole	None	View ...
Advisor Reviews Contributor	View reviews for a workload and triage recommendations linked to them.	BuiltinRole	None	View ...
Advisor Reviews Reader	View reviews for a workload and recommendations linked to them.	BuiltinRole	None	View ...
AgFood Platform Dataset Admin	Provides access to Dataset APIs	BuiltinRole	None	View ...

myGRBAC | Access control (IAM)

Number of role assignments for this subscription: 2

Name	Type	Role	Scope	Condition
Azeem jinad	User	Owner	Subscription (Inherited)	None
Azeem jinad	User	Owner	Subscription (Inherited)	None
Azeem jinad	User	Virtual Machine Contributor	This resource	None



5.4.2 Monitor role assignments and remove a role

Create role assignment

Sat Feb 08 2025 17:42:30 GMT+0000 (Greenwich Mean Time)

Summary	JSON	Change history
Resource	/subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/myGRBAC/providers/Microsoft.Authorization/roleAssignments/c39d7bc2-5a36-4f99-9a78-696a891a1516	
Operation name	Create role assignment	
Time stamp	Sat Feb 08 2025 17:42:30 GMT+0000 (Greenwich Mean Time)	
Event initiated by	ajinad407@outlook.com	
Message	-	
Role	-	
Scope	-	

5.5 Manage Resource Locks (slides 44-46)

5.5.1 Create a resource group

The screenshot shows the Microsoft Azure Resource Groups page for the resource group "myRGLocks". The left sidebar lists other resource groups: "CH3ResourceGroup", "myRGLocks", and "myRBAC". The main content area has a search bar and various navigation buttons like "Create", "Manage view", "Delete resource group", "Refresh", "Export to CSV", "Open query", "Assign tags", "Move", "Delete", "Export template", and "Open in mobile". A "JSON View" link is also present. The "Essentials" section shows the subscription details: "Subscription (move) : Azure subscription 1", "Subscription ID : f1227c80a-839c-4099-bb90-9c4e8e76fa59", and "Location : East US". The "Resources" section displays a message: "No resources match your filters. Try changing or clearing your filters." It includes buttons for "Create resources" and "Clear filters". Below this, there's a "Learn more" link and a "Give feedback" button. The bottom status bar shows the date and time: "6:05 PM 2/6/2025".

5.5.2 Add a lock to the resource group and test deletion

The screenshot shows the Microsoft Azure Locks page for the resource group "myRGLocks". The left sidebar lists other resource groups: "CH3ResourceGroup", "myRGLocks", and "myRBAC". The main content area shows a table of locks:

Lock name	Lock type	Scope	Notes
locks407	Read-only	myRGLocks	

Below the table are buttons for "Edit" and "Delete". The bottom status bar shows the date and time: "6:08 PM 2/6/2025".

The screenshot shows the Microsoft Azure Resource Groups page. The main header bar includes the Microsoft Azure logo, an Upgrade button, a search bar, and Copilot. The top navigation bar shows the path "Home > Resource groups". On the left, a sidebar lists "Resource groups" with items like "Create", "Manage view", and a search bar. Below this is a list of resource groups: "CH3ResourceGroup", "myRGLocks", and "myRGRBAC". The main content area is titled "myRGLocks" and shows the "Overview" tab. It displays basic information: Subscription (move) to "Azure subscription 1", Subscription ID: "fd27c80a-839c-4099-bb90-9c4e8e76fa59", Location: "East US", and Tags: "Add tags". A message at the top right states: "Delete resource group myRGLocks failed. The resource group myRGLocks is locked and can't be deleted. Click here to manage locks for this resource group." Below this is a "Help me troubleshoot" button. The "Resources" section shows no results with the message "No resources match your filters". The bottom of the page includes a "Page 1 of 1" navigation, a Windows taskbar with various pinned icons, and a status bar showing "4°C Cloudy" and the date/time "6:10 PM 2/8/2025".

5.5.3 Test deleting a member of the resource group

The screenshot shows the Microsoft Azure Storage Accounts creation page. The top header bar includes the Microsoft Azure logo, an Upgrade button, a search bar, and Copilot. The top navigation bar shows the path "Home > Storage accounts > Create a storage account". The main form is titled "Create a storage account" and has tabs for "Basics", "Advanced", "Networking", "Data protection", "Encryption", "Tags", and "Review + create". The "Basics" tab is selected, showing fields like "Subscription" (Azure subscription 1), "Resource group" (myRGLocks), "Location" (East US), "Storage account name" (storageaccount407), "Primary service" (Standard), and "Replication" (Locally-redundant storage (LRS)). The "Advanced" tab shows settings for "Enable hierarchical namespace", "Enable SFTP", "Enable network file system v3", "Allow cross-tenant replication", "Access tier", and "Enable large file shares". The "Security" tab shows settings for "Secure transfer", "Blob anonymous access", "Allow storage account key access", and "Default to Microsoft Entra authorization in the Azure portal". At the bottom, there are "Previous", "Next", and "Create" buttons. To the right of the form, an "Errors" panel is open, showing a "Summary" tab and an "ERROR TYPE" section. The error message reads: "The scope '/subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/myRGLocks/providers/Microsoft.Resources/deployments/storageAccount407_1739038368v21' cannot perform write operation because it's being locked by another operation. The lock ID is 'fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/myRGLocks'. Please remove the lock and try again." It also includes a "(Code: ScopeLocked)" link, an "Explain with Copilot" button, and links for "Troubleshooting Options" and "New Support Request". The bottom of the page includes a "Give feedback" link and a status bar showing "4°C Cloudy" and the date/time "6:14 PM 2/8/2025".

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes 'Microsoft Azure', 'Upgrade', 'Search resources, services, and docs (G+)', 'Copilot', and user information 'ajinad407@outlook.com DEFAULT DIRECTORY (AJINAD407)'. The main content area displays the 'myRGLocks' resource group. On the left, a sidebar lists various management options like Overview, Activity log, Access control (IAM), Tags, Resource visualizer, Events, Settings, Deployments, Security, Deployment stacks, Policies, Properties, and Locks. The 'Locks' option is currently selected. The main pane shows a table of locks. A specific row for 'storageaccount407' is highlighted with a red border, indicating it's selected. A modal window titled 'Executed delete command on 1 selected items' appears, stating 'storageaccount407: The scope '/subscriptions/fd27c0ba-839c-409b-b690-9c4e8e76f59/resourceGroups/myRGLocks/providers/Microsoft.Storage/storageAccounts/storageaccount407' cannot perform delete operation because following scope(s) are locked: /subscriptions/fd27c0ba-839c-409b-b690-9c4e8e76f59/resourceGroups/myRGLocks'. Please remove the lock and try again. (Code: ScopeLocked)'.

5.5.4 Remove the resource lock

This screenshot shows the 'myRGLocks | Locks' page in the Microsoft Azure portal. The top navigation bar is identical to the previous screenshot. The main content area shows a table with columns 'Lock name', 'Lock type', 'Scope', and 'Notes'. A note at the top of the table states 'This resource has no locks.' The left sidebar shows the 'Locks' option is selected. The bottom of the screen shows a taskbar with various pinned icons and the system clock indicating 6:24 PM on 2/6/2025.

The screenshot shows the Microsoft Azure Resource Group Overview page for a resource group named 'myRGLocks'. The 'Essentials' section displays basic information about the subscription, including the subscription ID and location. The 'Resources' section shows a message: 'No resources match your filters'. The 'Recommendations' section is also visible. On the right, there is a 'Notifications' sidebar showing a recent deployment log entry.

5.6 Implement resource tagging (slide 57) – (no screenshots required)

NO INSTRUCTION

5.7 Explore the Trust Center (slides 61-64) – (no screenshots required)

5.7.1 Access the Trust Center

5.7.2 Access the Service Trust Portal (STP)

5.7.3 Access the Compliance Manager

Chapter 7

7.1 Deploy your first IoT Edge module to a virtual Windows device (slides 7-11)

7.1.1 Create an IoT hub

```

az iot hub create \
--resource-group IoTEdgeResources \
--name MyIoTHub12345 \
--sku F1 \
--partition-count 2

"etag": "AAAAAAAYAAAA=",
"id": "/subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/IoTEdgeResources/providers/Microsoft.Devices/IotHubs/MyIoTHub12345",
"identity": {
"principalId": null,
"tenantId": null,
"type": "None",
"userAssignedIdentities": null
},
"location": "eastus",
"name": "MyIoTHub12345",
"properties": {
"allowedFqdnList": [],
"authorizationPolicies": null,
"cloudToDevice": {
"defaultTtlAsIso8601": "1:00:00",
"feedback": {
"lockDurationAsIso8601": "0:00:05",
"maxDeliveryCount": 10,
"ttlAsIso8601": "1:00:00"
},
"maxDeliveryCount": 10
},
"comments": null,
"deviceStreams": null,
"disableDeviceCa": null,
"disableLocalAuth": null,
"disabledCertificates": null,
"enableCloudToDevice": null,
"enableFileUploadNotifications": false,
"encryption": null,
"eventHubEndpoints": {
"events": {
"endpoint": "sb://ihsupprod0res015dednamespace.servicebus.windows.net/",
"partitionCount": 2,
"partitionIds": [
"1"
]
}
},
"path": "iothub-ehub-myiothub12-64451721-be7c0bc1da",

```

MyIoTHub12345

Overview

Resource group (move) : IoTEdgeResources

Status : Active

Location : East US

Service region : East US

Subscription (move) : Azure subscription 1

Tier : Free

Daily message limit : 8,000

Minimum TLS Version : 1.0

Show data for last: 1 Hour 6 Hours 12 Hours 1 Day 7 Days 30 Days

IoT Hub Usage

Number of messages used
100
90
80
70
60
50
40
30
20
10
0

Device to cloud messages

Device to cloud messages
100
90
80
70
60
50
40
30
20
10
0

```

az iot hub create \
--resource-group IoTEdgeResources \
--name MyIoTHub12345 \
--sku F1 \
--partition-count 2

"etag": "AAAAAAAYAAAA=",
"id": "/subscriptions/fd27c80a-839c-4099-bb90-9c4e8e76fa59/resourceGroups/IoTEdgeResources/providers/Microsoft.Devices/IotHubs/MyIoTHub12345",
"identity": {
"principalId": null,
"tenantId": null,
"type": "None",
"userAssignedIdentities": null
},
"location": "eastus",
"name": "MyIoTHub12345",
"properties": {
"allowedFqdnList": [],
"authorizationPolicies": null,
"cloudToDevice": {
"defaultTtlAsIso8601": "1:00:00",
"feedback": {
"lockDurationAsIso8601": "0:00:05",
"maxDeliveryCount": 10,
"ttlAsIso8601": "1:00:00"
},
"maxDeliveryCount": 10
},
"comments": null,
"deviceStreams": null,
"disableDeviceCa": null,
"disableLocalAuth": null,
"disabledCertificates": null,
"enableCloudToDevice": null,
"enableFileUploadNotifications": false,
"encryption": null,
"eventHubEndpoints": {
"events": {
"endpoint": "sb://ihsupprod0res015dednamespace.servicebus.windows.net/",
"partitionCount": 2,
"partitionIds": [
"1"
]
}
},
"path": "iothub-ehub-myiothub12-64451721-be7c0bc1da",

```

7.1.2 Register an IoT Edge device

```

azeez [ ~ ]$ az iot hub device-identity create \
--device-id myEdgeDevice \
--edge-enabled \
--hub-name MyIoTHub12345
{
  "attributes": null,
  "authentication": {
    "symmetricKey": {
      "primaryKey": "ZDrwsBsAjWOIGWBsSjrYFl/E/kExn7clg+oY4DSNsU=",
      "secondaryKey": "n8vJFLcd0081qgxPn09FzLXtbgrryZf91kMska14="
    }
  },
  "capabilities": {
    "iotEdge": true
  },
  "cloudToDeviceMessageCount": 0,
  "connectionState": "Disconnected",
  "connectionStateUpdatedTime": "2001-01-01T00:00:00+00:00",
  "deviceId": "myEdgeDevice",
  "deviceScope": "ms-azure-iot-edge://myEdgeDevice-638763436562616217",
  "etag": "0012hAjwN4M",
  "generatedId": "638763436562616217",
  "lastActivityTime": "2001-01-01T00:00:00+00:00",
  "parentScopes": [],
  "status": "enabled",
  "statusReason": null,
  "statusUpdatedTime": "2001-01-01T00:00:00+00:00"
}
azeez [ ~ ]$ []

```

```

azeez [ ~ ]$ az iot hub device-identity show --device-id myEdgeDevice --hub-name MyIoTHub12345
{
  "authentication": {
    "symmetricKey": {
      "primaryKey": "ZDrwsBsAjWOIGWBsSjrYFl/E/kExn7clg+oY4DSNsU=",
      "secondaryKey": "n8vJFLcd0081qgxPn09FzLXtbgrryZf91kMska14="
    }
  },
  "capabilities": {
    "iotEdge": true
  },
  "cloudToDeviceMessageCount": 0,
  "connectionState": "Disconnected",
  "connectionStateUpdatedTime": "2001-01-01T00:00:00+000000Z",
  "deviceId": "myEdgeDevice",
  "deviceScope": "ms-azure-iot-edge://myEdgeDevice-638763436562616217",
  "etag": "0012hAjwN4M",
  "generatedId": "638763436562616217",
  "hub": "MyIoTHub12345.azure-devices.net",
  "lastActivityTime": "2001-01-01T00:00:00.000000Z",
  "parentScopes": [],
  "status": "enabled",
  "statusReason": null,
  "statusUpdatedTime": "2001-01-01T00:00:00.000000Z"
}

```

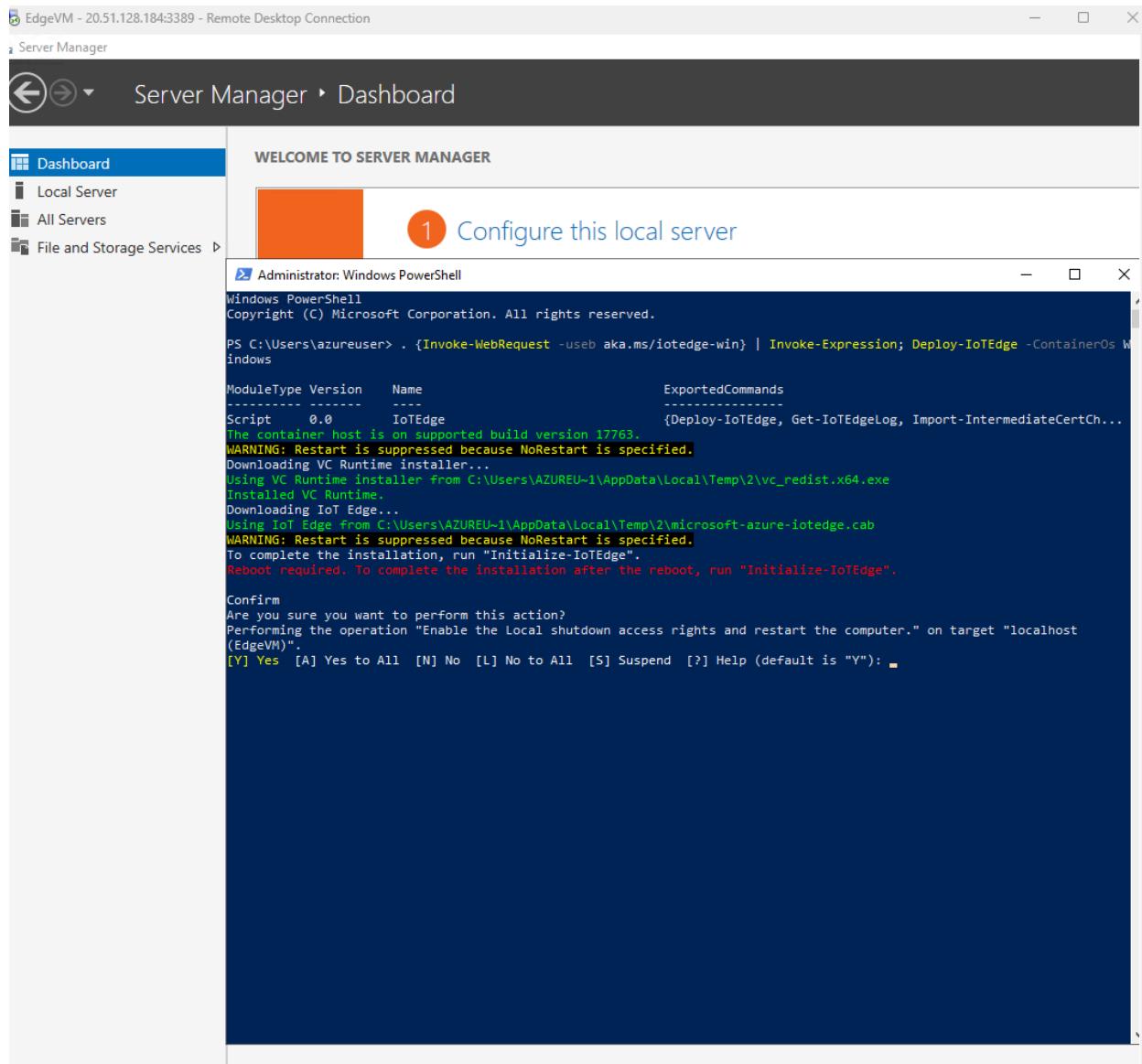
```

azeez [ ~ ]$ az iot hub device-identity connection-string show \
--device-id myEdgeDevice \
--hub-name MyIoTHub12345
"connectionString": "HostName=MyIoTHub12345.azure-devices.net;DeviceId=myEdgeDevice;SharedAccessKey=ZDrwsBsAjWOIGWBsSjrYFl/E/kExn7clg+oY4DSNsU="
azeez [ ~ ]$ []

```

```
{
  "connectionString": "HostName=MyIoTHub12345.azure-devices.net;DeviceId=myEdgeDevice;SharedAccessKey=ZDrwsBsAjWOIGWBsSjrYFl/E/kExn7clg+oY4DSNsU="
}
```

7.1.3 Install and start the IoT Edge runtime



EdgeVM - 20.51.128.184:3389 - Remote Desktop Connection

Server Manager

Server Manager ▶ Dashboard

Dashboard Local Server All Servers File and Storage Services ▶

WELCOME TO SERVER MANAGER

1 Configure this local server

Administrator: Windows PowerShell

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\azureuser> . {Invoke-WebRequest -useb aka.ms/iotedge-win} | Invoke-Expression; Initialize-IoTEdge -ContainerOs Windows

ModuleType Version Name ExportedCommands
---- -- -- ----
Script 0.0 iotEdge {Deploy-IoTEdge, Get-IoTEdgeLog, Import-IntermediateCertCh...}

cmdlet Initialize-IoTEdge at command pipeline position 1
Supply values for the following parameters:
DeviceConnectionString: "HostName=MyIoTHub12345.azure-devices.net;DeviceId=myEdgeDevice;SharedAccessKey=ZDwvB8AjWQ1GWSsJnYf1/E/kExn7clg+oY4DSN4sU="
The container host is on supported build version 17763.
System PATH does not require an update.
Generating config.yaml...
Configured device for manual provisioning.
Configured device with hostname 'EdgeVM'.
Configured ProgramData directory.
Configured device with Moby Engine URL 'npipe://./pipe/iotedge_moby_engine' and network 'nat'.
Initialized the IoT Edge service.

This device is now provisioned with the IoT Edge runtime.
Check the status of the IoT Edge service with "Get-Service iotedge"
List running modules with "iotedge list"
Display logs from the last five minutes in chronological order with "Get-IoTEdgeLog"

PS C:\Users\azureuser> ■
```

EdgeVM - 20.51.128.184:3389 - Remote Desktop Connection

Server Manager

Server Manager ▶ Dashboard

Dashboard Local Server All Servers File and Storage Services ▶

Administrator: Windows PowerShell

```
PS C:\Users\azureuser> Test-Path C:\ProgramData\iotedge\config.yaml
True
PS C:\Users\azureuser> notepad C:\ProgramData\iotedge\config.yaml
PS C:\Users\azureuser> Restart-Service iotedge
WARNING: Waiting for service 'Azure IoT Edge Daemon (iotedge)' to stop...
WARNING: Waiting for service 'Azure IoT Edge Daemon (iotedge)' to stop...
PS C:\Users\azureuser> Get-Service iotedge

Status Name DisplayName
----- ---- -----
Running iotedge Azure IoT Edge Daemon

PS C:\Users\azureuser> iotedge list
NAME STATUS DESCRIPTION CONFIG
edgeAgent running Up a minute mcr.microsoft.com/azureiotedge-agent:1.1
PS C:\Users\azureuser> ■
```

7.1.4 Deploy a module

Now, view and manage Deployments in the new [Configurations + Deployments](#) page.

IoT Edge Device **IoT Edge Deployments**

IoT Edge deployments configure sets of IoT Edge devices to run IoT Edge modules. Each deployment continuously ensures that all matching devices are running the specified set of modules, even when new devices are created or are modified to match the target condition. [Learn more](#)

+ Add Deployment + Add Layered Deployment Refresh Delete

ID	Type	Target Condition	Priority	System Metrics	Device Metrics	Custom Metrics	Created
simulatedtemperaturesensor	Deployment	deviceId='myEdgeDevice'	0	1 Targeted 1 Applied	0 Reporting Success 0 Reporting Failure	Metrics have not been defined or...	2/28/2025, 3:49:00 ...

Switch to PowerShell Restart Manage files New session Editor Web preview Settings Help

Modules	IoT Edge hub connections	Deployments and Configurations			
SedgeAgent	IoT Edge System Module	✓ Yes	✓ Yes	running	NA
SedgeHub	IoT Edge System Module	✓ Yes	✓ Yes	running	NA
SimulatedTemperatureSensor	IoT Edge Custom Module	✓ Yes	✓ Yes	running	NA

```

Administrator:WindowsPowerShell
PS C:\Users\lazureuser> Get-Service iotedge
Status Name DisplayName
----- ---- -----
Running iotedge Azure IoT Edge Daemon

PS C:\Users\lazureuser> iotedge list
Name          Status   STATUS    DESCRIPTION      CONFIG
SimulatedTemperatureSensor running Up 2 minutes mcr.microsoft.com/azureiotedge-simulated-temperature-sensor:1.0
edgeagent     running Up 3 minutes mcr.microsoft.com/azureiotedge-agent:1.1
edgehub       running Up 2 minutes mcr.microsoft.com/azureiotedge-hub:1.1

SimulatedTemperatureSensor Main() started.
Initializing simulated temperature sensor to send 500 messages, at an interval of 5 seconds.
To change the number of messages, set $env:MESSAGECOUNT to the number of messages that should be sent (set it to -1 to send unlimited messages).
[Information]: Trying to initialize module client using transport type [Ampq_Tcp_Only].
SimulatedTemperatureSensor Main() started.
Initializing simulated temperature sensor to send 500 messages, at an interval of 5 seconds.
To change the number of messages, set $env:MESSAGECOUNT to the number of messages that should be sent (set it to -1 to send unlimited messages).
[Information]: Trying to initialize module client using transport type [Ampq_Tcp_Only].
[Information]: Successfully initialized module client of transport type [Ampq_Tcp_Only].
SimulatedTemperatureSensor Main() started.
Initializing simulated temperature sensor to send 500 messages, at an interval of 5 seconds.
To change the number of messages, set $env:MESSAGECOUNT to the number of messages that should be sent (set it to -1 to send unlimited messages).
[Information]: Trying to initialize module client using transport type [Ampq_Tcp_Only].
2/28/2025 11:47:49 PM Sending message: 1, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:47:54 PM Sending message: 2, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:00 PM Sending message: 3, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:05 PM Sending message: 4, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:10 PM Sending message: 5, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:15 PM Sending message: 6, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:20 PM Sending message: 7, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:25 PM Sending message: 8, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:30 PM Sending message: 9, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:35 PM Sending message: 10, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:40 PM Sending message: 11, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:45 PM Sending message: 12, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:50 PM Sending message: 13, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:48:55 PM Sending message: 14, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:00 PM Sending message: 15, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:05 PM Sending message: 16, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:10 PM Sending message: 17, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:15 PM Sending message: 18, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:20 PM Sending message: 19, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:25 PM Sending message: 20, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:30 PM Sending message: 21, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:35 PM Sending message: 22, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:40 PM Sending message: 23, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:45 PM Sending message: 24, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:50 PM Sending message: 25, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:55 PM Sending message: 26, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:49:56 PM Sending message: 27, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]
2/28/2025 11:50:00 PM Sending message: 28, Body: [{"machine":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient":{"temperature":21.171636964597233,"humidity":24,"pressure":1.0723863227267255}, "ambient": {"temperature":20.63547999428295,"humidity":26}, "timeCreated": "2025-02-28T23:47:49.86607612"}]

```

Chapter 8

8.1 Create a classification model with AutoML in Azure Machine Learning (slides 10-16)

8.1.1 Create a workspace

The screenshot shows the Azure Machine Learning workspace 'MyMLWorkspace'. The 'Overview' tab is selected, displaying the following details:

Resource group	: CHAPTER8CG
Location	: East US
Subscription	: Azure subscription 1
Storage	: mymlworkspace7039443553
Provisioning State	: Succeeded
Studio web URL	: https://ml.azure.com/?tid=5abb02f5-d6ea-4dbb-833a-5df2ceebdc46&wsid=/subscriptions/...
Container Registry	: --
Key Vault	: mymlworkspace301331624
Application Insights	: mymlworkspace2600057774
Mlflow tracking URI	: azureml://eastus.api.azuredi.ms/mlflow/v1.0/subscriptions/fd27cd0a-839c-4099-bb50-9c4...

Below the table, there is a large grey 3D pyramid icon. Further down, a section titled 'Work with your models in Azure Machine Learning Studio' provides a brief introduction to the studio and a 'Launch studio' button.

8.1.2 Start Azure Machine Learning Studio

The screenshot shows the Azure Machine Learning Studio interface for the workspace 'MyMLWorkspace'. The left sidebar includes navigation links for Home, Model catalog, Authoring, Assets, and Manage. The main area is divided into several sections:

- Generative AI with Prompt flow**: Includes cards for 'Multi-Round Q&A on Your Data', 'Q&A on Your Data', 'Web Classification', 'Chat with Wikipedia', and 'Use GPT Function'.
- Generative AI models**: Shows cards for 'Phi-4' (Chat completion), 'Llama-3.3-70B-Instruct' (Chat completion), 'DeepSeek-R1-Distilled-NPU-O...' (Chat completion), 'qpt-4.5-preview' (Chat completion), and 'Phi-4-multi' (Chat completion).
- Notebook samples**: Includes cards for 'Get started: Train and deploy a model', 'Index and search your own data with GPT', 'Distributed GPU training', and 'Automate with Pipelines'.

At the bottom, there is a 'Shortcuts' section and a taskbar with various application icons.

8.1.3 Create and load dataset

Azure AI | Machine Learning Studio

Default Directory > MyMLWorkspace > Training job

Submit an Automated ML job

Training method

- ✓ Basic settings
- Task type & data
- Task settings
- Compute
- Review

Task type & data

Choose the type of task that you would like your model to perform and the data to use for training. [Learn more](#)

Select task type *

Classification

Select data

Make sure your data is preprocessed into a supported format.

+ Create Refresh Show supported data assets only Reset view

Name	Type	Created on	Modified on
bankMarketing	Table	Mar 1, 2025 2:20 PM	Mar 1, 2025 2:20 PM

Page 1 of 1 25/Page

Back Next Cancel

Azure AI | Machine Learning Studio

Default Directory > MyMLWorkspace > Compute

Compute

The "Kubernetes clusters" tab is now where you can access previous versions of "inference clusters" (also known as "AKS clusters") and "attached Kubernetes" compute types along with any previously created compute targets using those types. [Learn more about Kubernetes clusters](#)

Compute instances **Compute clusters** **Kubernetes clusters** **Attached computes** **Serverless instances**

Choose from a selection of CPU or GPU instances preconfigured with popular tools such as VS Code, JupyterLab, Jupyter, and RStudio, ML packages, deep learning frameworks, and GPU drivers. [Learn more about compute instances](#)

+ New Refresh Start Stop Restart Schedule and idle shutdown Delete Reset view View quota

Name	State	Idle shutdown	Applications	Size	Created on	Assigned to
automl-comput	Running	1 hour	JupyterLab Jupyter VS Code (Web) ...	Standard_DS12_v2	Mar 1, 2025 2:51 PM	Azeez Jinad

8.1.4 Configure experiment run

The screenshot shows the Azure AI | Machine Learning Studio interface. On the left, the navigation sidebar is visible with sections like All workspaces, Home, Model catalog, Authoring, Assets, and Manage. Under Authoring, the 'Jobs' section is selected. In the main content area, the experiment 'magenta_ice_bcb6h90fq' is shown as 'Running'. The experiment details include its status, created date (Mar 1, 2025), start time (Mar 1, 2025 4:40 PM), compute target ('automl-compute'), name ('magenta_ice_bcb6h90fq'), and script name ('--'). The 'Properties' tab is active, showing the status as 'Running'. The 'Inputs' tab shows the input name as 'training_data' and the data asset as 'BankMarketingData1'. The 'Best model summary' section indicates 'No data'. The 'Run summary' section shows the task type as 'Classification', primary metric as 'AUC weighted', and experiment name as 'MyAutoMLExperiment'. The bottom status bar shows the system is 'Sunset coming' at 5:42 PM.

8.1.5 Explore models

The screenshot shows the Azure AI | Machine Learning Studio interface. The navigation sidebar is identical to the previous screenshot. The experiment 'bubbly_basket_s9bwmhbw0' is now shown as 'Completed'. The experiment details are similar to the previous one, but the status is now 'Completed'. The 'Properties' tab is active, showing the status as 'Completed'. The 'Inputs' tab shows the input name as 'training_data' and the data asset as 'BankMarketingData1'. The 'Outputs' tab shows the output name as 'best_model' and the model as 'azurerm_bubbly_basket_s9bwmhbw0_40_output_miflow_log_model_501899705:1'. The 'Best model summary' section shows the algorithm name as 'VotingEnsemble', ensemble details, AUC Weighted (0.9480), and sampling (100.00%). The bottom status bar shows the system is 'Mostly cloudy' at 9:17 PM.

8.1.6 Deploy the best model

Azure AI | Machine Learning Studio

... > MyMLWorkspace > Jobs > MyAutoMLExperiment > bubbly_basket_s9wmhhbw0 > magenta_street_pxz262p1

magenta_street_pxz262p1 Completed

Overview Model Explanations (preview) Responsible AI (preview) Metrics Data transformation (preview) Test results (preview) Outputs + logs Images Child jobs Code Monitoring

Refresh Deploy Download Explain model View generated code Test model (preview) Register model Cancel Delete

Model summary

Algorithm name: VotingEnsemble

Ensemble details: [View ensemble details](#)

AUC weighted: 0.94803 [View all other metrics](#)

Sampling: 100.00 %

Registered models: No registration yet

Deploy status: No deployment yet

9:42 PM 3/1/2025

This screenshot shows the 'Model' tab for a completed AutoML experiment. The model is a VotingEnsemble with an AUC weighted score of 0.94803. It has no registered models or deployed endpoints.

Azure AI | Machine Learning Studio

... > MyMLWorkspace > Jobs > MyAutoMLExperiment > bubbly_basket_s9wmhhbw0 > magenta_street_pxz262p1

magenta_street_pxz262p1 Completed

Overview Model Explanations (preview) Responsible AI (preview) Metrics Data transformation (preview) Test results (preview) Outputs

Refresh Deploy Download Explain model View generated code Test model (preview) Register model

Model summary

Algorithm name: VotingEnsemble

Ensemble details: [View ensemble details](#)

AUC weighted: 0.94803 [View all other metrics](#)

Sampling: 100.00 %

Registered models: No registration yet

Deploy status: No deployment yet

Deploy bubblybaskets9b40:1

For the selected model, the scoring script and environment are auto generated for you. [Learn More](#)

Current Project resource: MyMLWorkspace

Instance count * 3

Virtual machine * Standard_E2s_v3 2 Cores, 16 GB (RAM), 32 GB (Disk), \$0.13/hr

Endpoint:

New Existing

Endpoint name * mymlworkspace-fvba

An endpoint URL will be generated after creating an endpoint.
https://mymlworkspace-fvba.eastus.inference.ml.azure.com/score

Learn how to consume

Deployment name * bubblybaskets9b40-1

Inferencing data collection

Disabled

Package Model

Disabled

Deploy Cancel More options

10:03 PM 3/1/2025

This screenshot shows the 'Deploy' dialog for the 'magenta_street_pxz262p1' model. It includes fields for instance count (3), virtual machine (Standard_E2s_v3), endpoint creation (New), endpoint name (mymlworkspace-fvba), deployment name (bubblybaskets9b40-1), and inferencing data collection (disabled). The dialog also provides links for learning how to consume the endpoint and viewing more options.

The screenshot shows the Azure AI | Machine Learning Studio interface. The left sidebar includes sections for All workspaces, Home, Model catalog, Authoring (Notebooks, Automated ML, Designer, Prompt flow), Assets (Data, Components, Pipelines, Environments, Models, Endpoints), Manage (Compute, Monitoring, Data Labeling, Linked Services, Connections), and a weather widget. The main content area displays a completed model deployment for 'magenta_street_pxa262p1'. The 'Model' tab is selected, showing a summary of the algorithm name (VotingEnsemble), AUC weighted (0.94803), and sampling (100.0%). It also lists registered models ('bubblybasket9b40:1') and indicates no deployment yet. A success message at the top states 'Success: Model deployment is successfully triggered'. The top right corner shows 'Azure subscription 1' and 'MyMLWorkspace'.

Chapter 9 (7 Total points)

9.1 Real-time Monitoring with Azure & Power BI (slides 9-16)

9.1.1 Add a consumer group to your IoT hub

The screenshot shows the Microsoft Azure IoT Hub 'Built-in endpoints' configuration page for 'my-IoT-Hub-chapter9'. The left sidebar lists options like Overview, Activity log, Access control (IAM), Tags, Diagnose and solve problems, Events, Resource visualizer, Device management, Hub settings, and Built-in endpoints (selected). Under Built-in endpoints, options include Message routing, File upload, Failover, Pricing and scale, Properties, Locks, Security settings, Defender for IoT, Monitoring, Automation, and Help. The main content area shows the configuration for the 'Event Hub-compatible endpoint'. It includes fields for 'Event Hub-compatible name' (set to 'my-iothub-chapter9'), 'Retain for' (set to 1 Day), 'Consumer Group' (set to 'powerbi-stream'), and a 'Create new consumer group' button. Below this is the 'Event Hub compatible endpoint' section, which lists a 'Shared access policy' ('iothubowner') and its endpoint ('Endpoint=sb://iothub-ns-my-iothub-64536081-2957cc5230.servicebus.windows.net/?SharedAccessKeyName=iothubowner&SharedA...'). The bottom section is 'Cloud to device messaging', which includes 'Default TTL' (1 Hour), 'Feedback retention time' (1 Hour), and 'Maximum delivery count' (10 Attempts).

9.1.2 Create a Stream Analytics job

The screenshot shows the Microsoft Azure Stream Analytics job overview page for 'iot-to-powerbi-stream'. The top navigation bar includes 'Microsoft Azure', 'Upgrade', 'Search resources, services, and docs (G+)', 'Copilot', and user information 'ajinad40@outlook.com' and 'DEFAULT DIRECTORY (AJINADAD)'. The main content area displays the job's status as 'Created' with various configuration details:

Setting	Value
Resource group (move)	: CHAPTER9GRP
Location	: East US
Status	: Created
Subscription (move)	: Azure subscription_1
Subscription ID	: fd27c80a-839c-4099-bb90-9c4e8e76fa59
Pricing plan	: StandardV2 (manage)
Tags (edit)	: Add tags

Below the configuration table, there are two main options for building the job:

- I want to build my job using a query**: This option uses the 'Query editor' to build the job using Azure Stream Analytics Query Language to transform or analyze real-time data. It includes a 'Get started' button.
- I want to build my job without code**: This option uses the 'No-code editor' to build the job without a single line of code. It includes a 'Get started' button.

At the bottom right, there is a note: 'Use Azure Stream Analytics no-code editor to build your job without a single line of code.'

9.1.3 Add an input to the Stream Analytics job

The screenshot shows the Microsoft Azure Stream Analytics job inputs page for 'iot-to-powerbi-stream'. The top navigation bar is identical to the previous screenshot. The main content area shows a table of existing inputs:

Alias	Source type	Type	Authentication mode	Resource
iotinput	Stream	IoT Hub	Connection string	my-ioHub-chapter9

The left sidebar shows the 'Inputs' section selected under 'Job topology'. Other sections include 'Functions', 'Query', 'Outputs', and 'No-code editor (preview)'. The bottom of the page includes standard Azure navigation links like 'Home', 'StreamAnalyticsJob | Overview', and 'iot-to-powerbi-stream'.

9.1.4 Add an output to the Stream Analytics job

Microsoft Azure

Home > StreamAnalyticsJob | Overview > iot-to-powerbi-stream

iot-to-powerbi-stream | Outputs

Stream Analytics job

Search Add output Refresh

Overview Activity log Access control (IAM) Tags Diagnose and solve problems Resource visualizer Job topology Inputs Functions Query Outputs No-code editor (preview) Settings Developer tools Monitoring Automation Help

Alias: powerbiOutput Type: Power BI Authentication mode: User token Resource:

Stream Analytics Power BI output will be retiring on 31st Oct 2027. Learn more

9.1.5 Configure the query of the Stream Analytics job

Microsoft Azure

Home > StreamAnalyticsJob | Overview > iot-to-powerbi-stream

iot-to-powerbi-stream | Query

Stream Analytics job

Search Start job Open in VS Code Diagnostic settings Refresh Query language docs Share feedback Tutorial

Overview Activity log Access control (IAM) Tags Diagnose and solve problems Resource visualizer Job topology Inputs Functions Query No-code editor (preview) Settings Developer tools Monitoring Automation Help

Inputs (1) Outputs (1) Functions (0)

Test query Save query Discard changes

```
1 /*  
2 Here are links to help you get started with Stream Analytics Query Language:  
3 Common query patterns - https://go.microsoft.com/fwlink/?linkid=619153  
4 Query language - https://docs.microsoft.com/stream-analytics-query/query-language-elements-azure-stream-analytics  
*/  
6 SELECT  
7 *  
8 INTO  
9 [powerbiOutput]  
10 FROM  
11 [iotInput]
```

Input preview Test results Job simulation (preview)

While sampling data, no data was received from '4' partitions.

Table Raw Refresh Select time range Upload sample input Download sample data

9.1.6 Run the Stream Analytics job

iot-to-powerbi-stream Stream Analytics job

Overview

Monitoring

Tutorials

Essentials

Resource group (move)	: CHAPTER8GRD
Location	: East US
Status	: Running
Subscription (move)	: Azure for Students
Subscription ID	: 481ce4cd-afe5-4e2c-b6e6-bcacdd46609
Pricing plan	: StandardV2 (manage)
Tags (edit)	: Add tags

Created: Thursday, March 6, 2025 2:49 PM
Started: Thursday, March 6, 2025 4:53 PM
Output watermark:
Cluster: Shared
Hosting environment: Cloud
Virtual Network: Disabled

Troubleshooting

Errors and warnings: No recent errors and warnings

Job diagram (preview): Visualize job parallelism and gain insights into job performance.

View all activity logs: View all the errors, warnings and operation logs.

Enable diagnostics: Turning on diagnostic settings to Log Analytics will allow you to easily troubleshoot any errors your job may encounter.

Key metrics: See all metrics

Show data for: Last 4 hours

Resource utilization: A line chart showing resource utilization over time.

Events count: A line chart showing event counts over time.

Watermark delay: A line chart showing watermark delay in minutes.

Backlogged input events: A line chart showing backlogged input events.

9.1.7 Create and publish a Power BI report to visualize the data

<https://app.powerbi.com/view?r=eyJrljoiN2U5NWUzNjQtZGI0NC00NzI0LWFIMGEtMTdIOTUxMWFhZDY0liwidCI6ImFjNzIINWE4LWUwZTQtNDM0Yi1hMjkyLTJjODIiNWMyODM2NilsImMiOjF9>

IoTDataSet

Sum of temperature by timestamp

Sum of humidity by timestamp

Filters

There aren't any filters to display.

```
<iframe title="IoTDataSet" width="600" height="373.5"
src="https://app.powerbi.com/view?r=eyJrljoiN2U5NWUzNjQtZGI0NC00NzI0LWFIMGEtMTdIOTUxMWFhZDY0liwidCI6ImFjNzIINWE4LWUwZTQtNDM0Yi1hMjkyLTJjODIiNWMyODM2NilsImMiOjF9" frameborder="0" allowFullScreen="true"></iframe>
```